THE

Mariner's Compaſs
RECTIFIED;

CONTAINING

TABLES,

Shewing the true Hour of the Day, the Sun being
upon any Point of the Compaſs: With the true
Time of the Riſing and Setting of the Sun and
Stars, and the Points of the Compaſs upon
which they riſe and ſet: With Tables of Am-
plitudes and Declination. Which Tables of
Sun-Dials, Semidiurnal Arches and Amplitudes
are calculated from the Equator to 60 Degrees
of Latitude, either North or South.

WITH

A Deſcription of the moſt uſeful Inſtruments in Practice in the
ART of NAVIGATION.

ALSO,

A TABLE of the LATITUDE and LONGITUDE
of PLACES.

By ANDREW WAKELY, Mathematician.

Enlarged with many uſeful Additions, by J. ATKINSON.

The Whole reviſed, corrected, improved and enlarged,
with new Tables and Examples,
By JOHN ADAMS, Teacher of the Mathematics,
And Author of the Young Sea Officer's Aſſiſtant.

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TO THE READER.

COURTEOUS READER,

WHEN I firſt entered upon theſe my Labours, and after I had begun the Calculations, I found that though the Book would be ſmall, yet my Labour was ſo great that I almoſt fainted. Yet, at Length, when I conſidered the ordinary, neceſſary, and frequent Uſe that might be made of theſe my Labours, I was thereby encouraged to go on and proſecute my Work; and how ready and eaſy I have made it for practice, will plainly appear, by immediate Inſpection, to the meaneſt Capacity.

Here follows a brief Explanation of the Method and Order of the Book: Firſt, you will find Tables *of the* Sun's Declination, *newly calculated from the beſt Hypotheſis yet diſcovered, and applied to the* Meridian of London, *whoſe* Latitude *is* 51d. 32m. *North, and* Longitude, *according to theſe Tables,* 0d. 0m. — *Next you will find* Tables, *ſhewing the true Hour and Minute of the Day, the* Sun *being upon any Point of the* Compaſs; *which* Tables *are as Dials, fitting all Places in the World, whoſe Pole is elevated not above* 60

60d. *either North or South: Likewiſe by theſe Tables you may know the true* Hour *and* Minute *of the Night, by the Bearing of any of the known* Fixed Stars *between the* Tropics: *Then you will find* Tables, *ſhewing the true* Time *of the* Sun's Riſing *and* Setting, *with the Length of the Day and Night. Alſo by theſe* Tables *you may find the true Time of* Riſing *and* Setting *of all the eminent* Fixed Stars *between the* Tropics. *Next you will find* Tables, *ſhewing the* Point of the Compaſs *that the* Sun *and all the above ſaid* Stars *riſe and ſet upon; which* Tables *are of excellent Uſe for readily finding the* Variation *of the Compaſs, and may be performed by a* Meridian Compaſs, *that is about ten Inches in* Diameter, *whoſe Points are divided into Halves and Quarters; ſuch a* Compaſs *I ſuppoſe to be convenient for a Mariner's Uſe, where he hath not an* Azimuth Compaſs. *Next you will find* Tables *of* Amplitudes *to every Degree of the* Sun's Declination: *All theſe* Tables *are calculated from the* Equator *to* 60 *Degrees of* Latitude, *either North or South: and they will laſt, with Exactneſs, as long as* GOD *upholdeth the* Order *and* Courſe *of* Nature.

In the Appendix *you will find the Uſe of all thoſe* Inſtruments *that are moſt in Practice in the Art of* NAVIGATION, *either for Operation or Obſervation:*

tion: Likewiſe a Table *containing the moſt principal Harbours, Headlands, and Iſlands in the* WORLD; *ſhewing the* Latitude *and* Longitude *at each of them, beginning the* Longitude *at the* Meridian *of* London; *the Whole diſpoſed in a new, and ſucceſſive Order.*

This Method, I own, but how I have acquitted myſelf therein, I ſhall leave to the Judgment and Experience of the moſt ſkilful Mariners that the World affords, which are my native Countrymen in England.

And now fare ever well, ſo wiſhes he,
Who is more yours, than he can ſeem to be.

ANDREW WAKELY.

ADVERTISEMENT.

ATKINSON's EPITOME, and WILSON's NAVIGATION WORKS, that have met with the general Approbation of the Public for near a Century, are re-publiſhed with copious Additions, containing an Introduction to Nautical Aſtronomy, the lunar Method of determining the Longitude at Sea, the Deſcription and Uſe of Hadley's Sextant and Octant, with many other Improvements; either of which Books, together with the Seaman's Daily Aſſiſtant, contains a complete Introduction to practical and theoretical Navigation.

TO THE
MARINERS
OF GREAT-BRITAIN.

GENTLEMEN,

AT the Requeſt of the Proprietors, I have reviſed and corrected the Mariners Compaſs, a Book that has ſtood the Teſt of many Years; nor is there a Work that contains more uſeful Knowledge for the wearied Seamen, who, from the Avocations of his neceſſary Duty, has not Time to attend to the Study of thoſe Branches of the Mathematics which conſtitute the learned Navigator; nevertheleſs, by the Aſſiſtance of this little Book, he is in ſome Meaſure equal to him; for, by Inſpection only, he can here determine an Azimuth Amplitude, or horary Angle, as truly, perhaps, as is abſolutely neceſſary in a common Voyage. Beſides there is no Work extant has ſuch a comprehenſive Collection of inſtrumental Navigation, Menſuration, &c.

In this Edition, the Uſe of the Croſs-Staff and Nocturnal is left out, and in Lieu thereof, a ſhort plain Deſcription of HADLEY's Quadrant in inſerted, with ſuch Examples and Improvements as are neceſſary to be underſtood by thoſe who uſe this accurate Inſtrument. There is alſo added to the Tables of Dials, before and after the Words SOUTH DECLINATION, the Effect, in Time, of the horizontal Refraction; to determine the firſt and laſt Appearance of the Sun's upper Limb, whereby a Watch may be regulated to a great Exactneſs, and the Inſtant that any celeſtial Body paſſes the Meredian nearly known; ſeveral other Alterations and Corrections have been made; but ſuch, I flatter myſelf, as will entitle me, Gentlemen, to the Honour of ſubſcribing myſelf,

Your obedient

humble Servant,

Edmonton, Auguſt
24, 1781.

John Adams.

Second Year after Leap-Year.

Sun's Declination 1786, 1790, 1794, 1798.

Days	Jan.		Feb.		March		April		May		June	
	South		South		South		North		North		North	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	22	59	16	58	7	24	4	43	15	13	22	8
2	22	53	16	40	7	1	5	6	15	30	22	15
3	22	48	16	23	6	38	5	29	15	48	22	23
4	22	41	16	5	6	15	5	52	16	6	22	30
5	22	34	15	46	5	52	6	15	16	23	22	36
6	22	27	15	28	5	29	6	37	16	40	22	43
7	22	19	15	9	5	5	7	0	16	56	22	49
8	22	11	14	50	4	42	7	22	17	12	22	54
9	22	3	14	31	4	18	7	45	17	28	22	59
10	21	54	14	11	3	55	8	7	17	44	23	4
11	21	44	13	52	3	31	8	29	18	0	23	8
12	21	35	13	32	3	8	8	51	18	15	23	12
13	21	24	13	11	2	44	9	12	18	30	23	15
14	21	14	12	51	2	21	9	34	18	44	23	18
15	21	3	12	30	1	57	9	55	18	58	23	21
16	20	51	12	10	1	33	10	17	19	12	23	23
17	20	39	11	49	1	10	10	38	19	26	23	25
18	20	27	11	27	0	46	10	59	19	39	23	26
19	20	14	11	6	0	22	11	20	19	52	23	27
20	20	1	10	45	Nor.	2	11	40	20	4	23	28
21	19	48	10	23	0	25	12	0	20	17	23	28
22	19	34	10	1	0	49	12	21	20	29	23	28
23	19	20	9	39	1	12	12	41	20	40	23	27
24	19	6	9	17	1	36	13	0	20	51	23	26
25	18	51	8	54	2	0	13	20	21	2	23	25
26	18	36	8	32	2	23	13	39	21	13	23	23
27	18	20	8	9	2	47	13	58	21	23	23	20
28	18	4	7	47	3	10	14	17	21	32	23	18
29	17	48			3	33	14	36	21	42	23	14
30	17	32			3	57	14	54	21	51	23	11
31	17	15			4	20			21	59		

Second after Leap-Year.

Sun's Declination 1786, 1790, 1794, 1798

Days	July		Auguſt		Sept.		Oct.		Nov.		Dec.	
	North		North		North		South		South		South	
	D.	M.	M.	D.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	7	17	57	8	9	3	21	14	36	21	54
2	22	3	17	42	7	48	3	44	14	55	22	3
3	22	58	17	26	7	26	4	8	15	14	22	12
4	22	53	17	10	7	3	4	31	15	32	22	20
5	22	47	16	54	6	41	4	54	15	50	22	28
6	22	41	16	38	6	19	5	17	16	8	22	35
7	22	35	16	21	5	56	5	40	16	26	22	42
8	22	28	16	4	5	34	6	3	16	44	22	48
9	22	21	15	47	5	11	6	26	17	1	22	54
10	22	13	15	29	4	48	6	49	17	18	22	59
11	22	5	15	11	4	25	7	11	17	34	23	4
12	21	57	14	53	4	2	7	34	17	51	23	9
13	21	48	14	35	3	39	7	56	18	7	23	13
14	21	39	14	16	3	16	8	19	18	22	23	16
15	21	30	13	58	2	53	8	41	18	38	23	19
16	21	20	13	39	2	30	9	3	18	53	23	22
17	21	10	13	20	2	7	9	25	19	8	23	24
18	21	0	13	0	1	43	9	47	19	22	23	26
19	20	49	12	41	1	20	10	9	19	36	23	27
20	20	38	12	21	0	57	10	31	19	49	23	28
21	20	26	12	1	0	33	10	52	20	3	23	28
22	20	14	11	41	0	10	11	13	20	16	23	28
23	20	2	11	20	Sou.	14	11	34	20	28	23	27
24	19	49	11	0	0	37	11	55	20	40	23	26
25	19	36	10	39	1	1	12	16	20	52	23	24
26	19	23	10	18	1	24	12	37	21	4	23	22
27	19	10	9	57	1	47	12	57	21	15	23	20
28	18	56	9	36	2	11	13	17	21	25	23	17
29	18	42	9	15	2	34	13	37	21	35	23	13
30	18	27	9	53	2	58	13	57	21	45	23	9
31	18	12	9	31			14	16			23	5

Firſt Year after Leap-Year.

Sun's Declination 1789, 1793, and 1797.

Days	Jan.		Feb.		March		April		May		June	
	South		South		South		North		North		North	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	22	57	16	53	7	18	4	49	15	17	22	10
2	22	52	16	35	6	55	5	12	15	35	22	17
3	22	46	16	18	6	32	5	31	15	53	22	25
4	22	39	15	59	6	9	5	58	16	10	22	32
5	22	32	15	41	5	45	6	21	16	27	22	38
6	22	25	15	23	5	22	6	44	16	44	22	44
7	22	17	15	4	4	59	7	6	17	1	22	50
8	22	9	14	45	4	35	7	28	17	17	22	55
9	22	0	14	25	4	12	7	51	17	33	23	0
10	21	51	14	6	3	48	8	13	17	48	23	5
11	21	42	13	46	3	25	8	35	18	4	23	9
12	21	32	13	26	3	1	8	57	18	19	23	13
13	21	21	13	6	2	38	9	18	18	33	23	16
14	21	11	12	45	2	14	9	40	18	48	23	19
15	20	59	12	25	1	50	10	1	19	2	23	21
16	20	48	12	4	1	27	10	22	19	16	23	24
17	20	36	11	43	1	3	10	43	19	29	23	25
18	20	23	11	21	0	39	11	4	19	42	23	27
19	20	11	11	0	0	16	11	25	19	55	23	27
20	19	58	10	38	Nor.	8	11	46	20	8	23	28
21	19	44	10	17	0	32	12	6	20	20	23	28
22	19	30	9	55	0	55	12	26	20	32	23	27
23	19	16	9	33	1	19	12	46	20	43	23	27
24	19	1	9	1	1	43	13	6	20	54	23	25
25	18	46	8	48	2	6	13	25	21	5	23	24
26	18	31	8	26	2	30	13	44		15	23	22
27	18	16	8	3	2	53	14	4	21	25	23	19
28	18	0	7	40	3	17	14	22	21	35	23	17
29	17	43			3	40	14	41	21	44	23	13
30	17	27			4	3	14	59	21	53	23	10
31	17	10			4	26			22	1		

Firſt after Leap-Year.

Sun's Declination 1789, 1793, 1797.

Days	July		Auguſt		Sept.		Oct.		Nov.		Dec.	
	North		North		North		South		South		South	
	D.	M.	M.	D.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	6	17	53	8	3	3	27	14	41	21	57
2	23	1	17	38	7	42	3	51	15	0	22	6
3	22	56	17	22	7	19	4	14	15	19	22	14
4	22	51	17	6	6	57	4	37	15	37	22	22
5	22	45	16	50	6	35	5	0	15	55	22	29
6	22	39	16	33	6	13	5	23	16	13	22	36
7	22	33	16	16	5	50	5	46	16	31	22	43
8	22	26	15	59	5	27	6	9	16	48	22	49
9	22	19	15	42	5	5	6	32	17	5	22	55
10	22	11	15	24	4	42	6	55	17	22	23	0
11	22	3	15	6	4	19	7	17	17	39	23	5
12	21	55	14	48	3	56	7	40	17	55	23	10
13	21	46	14	30	3	33	8	2	18	11	23	13
14	21	37	14	11	3	10	8	25	18	26	23	17
15	21	27	13	53	2	47	8	47	18	42	23	20
16	21	17	13	33	2	24	9	9	18	57	23	22
17	21	7	13	14	2	0	9	31	19	11	23	24
18	20	57	12	55	1	37	9	53	19	26	23	26
19	20	46	12	35	1	14	10	15	19	39	23	27
20	20	34	12	15	0	50	10	36	19	53	23	28
21	20	23	11	55	0	27	10	58	20	6	23	28
22	20	11	11	35	0	3	11	19	20	19	23	28
23	19	58	11	15	Sou.	20	11	40	20	31	23	27
24	19	46	10	54	0	44	12	1	20	44	23	25
25	19	33	10	33	1	7	12	22	20	55	23	24
26	19	19	10	12	1	30	12	42	21	6	23	22
27	19	6	9	51	1	54	13	2	21	17	23	19
28	18	52	9	30	2	17	13	23	21	28	23	16
29	18	38	9	9	2	41	13	42	21	38	23	12
30	18	23	8	47	3	4	14	2	21	48	23	8
	8	8	8	25			14	22			23	4

Leap-Year,

Sun's Declination 1788, 1792, 1796,

Days	Jan.		Feb.		March		April		May		June	
	South		South		South		North		North		North	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	1	17	6	7	12	4	55	15	22	22	11
2	22	56	16	49	6	49	5	18	15	39	22	19
3	22	50	16	31	6	26	5	41	15	57	22	26
4	22	44	16	13	6	3	6	4	16	14	22	33
5	22	38	15	55	5	40	6	26	16	31	22	40
6	22	31	15	37	5	17	6	49	16	48	22	46
7	22	23	15	18	4	53	7	11	17	4	22	51
8	22	15	14	59	4	30	7	34	17	21	22	57
9	22	7	14	40	4	6	7	56	17	37	23	1
10	21	58	14	21	3	43	8	18	17	52	23	6
11	21	49	14	1	3	19	8	40	18	7	23	10
12	21	39	13	41	2	56	9	2	18	22	23	14
13	21	29	13	21	2	32	9	24	18	37	23	17
14	21	19	13	1	2	8	9	45	18	51	23	20
15	21	8	12	40	1	45	10	6	19	5	23	22
16	20	57	12	20	1	21	10	28	19	19	23	24
17	20	45	11	59	0	57	10	49	19	33	23	26
18	20	33	11	38	0	34	11	9	19	46	23	27
19	20	20	11	16	0	10	11	30	19	58	23	28
20	20	8	10	55	Nor.	14	11	51	20	11	23	28
21	19	54	10	33	0	37	12	11	20	23	23	28
22	19	41	10	11	1	1	12	31	20	34	23	27
23	19	27	9	50	1	25	12	51	20	46	23	27
24	19	13	9	27	1	48	13	10	20	57	23	25
25	18	58	9	5	2	12	13	30	21	7	23	23
26	18	43	8	43	2	35	13	49	21	18	23	21
27	18	28	8	20	2	59	14	8	21	28	23	19
28	18	12	7	58	3	22	14	27	21	37	23	16
29	17	56	7	35	3	45	14	45	21	46	23	12
30	17	40			4	9	15	4	21	55	23	9
31	17	23			4	32			22	3		

Leap-Year.

Suns Declination 1788, 1792, 1796.

Days	July		Auguſt		Sept.		Oct.		Nov.		Dec.	
	North		North		North		South		South		South	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	5	17	49	7	58	3	33	14	45	21	59
2	23	0	17	34	7	36	3	56	15	4	22	8
3	22	55	17	18	7	14	4	20	15	23	22	16
4	22	50	17	2	6	52	4	43	15	42	22	24
5	22	44	16	46	6	29	5	6	16	0	22	31
6	22	38	16	29	6	7	5	29	16	18	22	38
7	22	31	16	12	5	44	5	52	16	35	22	45
8	22	24	15	55	5	22	6	15	16	53	22	51
9	22	17	15	37	4	59	6	38	17	10	22	56
10	22	9	15	20	4	36	7	0	17	26	23	2
11	22	1	15	2	4	13	7	23	17	43	23	6
12	21	53	14	44	3	50	7	46	17	59	23	11
13	21	44	14	25	3	27	8	8	18	15	23	14
14	21	34	14	7	3	4	8	30	18	30	23	18
15	21	25	13	48	2	41	8	53	18	45	23	21
16	21	15	13	29	2	18	9	15	19	0	23	23
17	21	5	13	10	1	55	9	37	19	15	23	25
18	20	54	12	50	1	31	9	58	19	29	23	26
19	20	43	12	30	1	8	10	20	19	43	23	27
20	20	32	12	10	0	45	10	42	19	56	23	28
21	20	20	11	50	0	21	11	3	20	9	23	28
22	20	8	11	30	Sou.	2	11	24	20	22	23	27
23	19	55	11	9	0	26	11	45	20	34	23	27
24	19	43	10	49	0	49	12	6	20	46	23	25
25	19	30	10	28	1	13	12	27	20	58	23	23
26	19	16	10	7	1	36	12	47	21	9	23	21
27	19	3	9	46	1	59	13	7	21	20	23	18
28	18	49	9	25	2	23	13	27	21	30	23	15
29	18	34	9	3	2	46	13	47	21	40	23	11
30	18	20	8	42	3	10	14	7	21	50	23	7
31	18	5	8	20			14	26			23	2

Third Year after Leap-Year,
Sun's Declination 1787, 1791, 1795, 1799.

Days	Jan..		Feb.		March		April		May		June	
	South		South		South		North		North		North	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	0	17	2	7	29	4	37	15	8	22	6
2	22	55	16	44	7	7	5	1	15	26	22	13
3	22	49	16	27	6	44	5	23	15	44	22	21
4	22	43	16	9	6	21	5	46	16	1	22	28
5	22	36	15	51	5	57	6	9	16	19	22	35
6	22	29	15	32	5	34	6	32	16	35	22	41
7	22	21	15	14	5	11	6	54	16	52	22	47
8	22	13	14	55	4	48	7	17	17	8	22	53
9	22	5	14	36	4	24	7	39	17	25	22	58
10	21	56	14	16	4	1	8	1	17	40	23	3
11	21	47	13	56	3	37	8	23	17	56	23	7
12	21	37	13	36	3	14	8	45	18	11	23	11
13	21	27	13	16	2	50	9	7	18	26	23	15
14	21	16	12	56	2	26	9	29	18	41	23	18
15	21	5	12	35	2	3	9	50	18	55	23	20
16	20	54	12	15	1	39	10	12	19	9	23	23
17	20	42	11	54	1	15	10	33	19	23	23	25
18	20	30	11	33	0	52	10	54	19	36	23	26
19	20	17	11	11	0	28	11	15	19	49	23	27
20	20	4	10	50	0	4	11	35	20	1	23	28
21	19	51	10	28	Nor.	20	11	56	20	14	23	28
22	19	37	10	6	0	43	12	16	20	26	23	28
23	19	23	9	44	1	7	12	36	20	37	23	27
24	19	9	9	22	1	30	12	56	20	49	23	26
25	18	54	9	0	1	54	13	15	21	0	23	25
26	18	39	8	37	2	18	13	35	21	10	23	23
27	18	24	8	15	2	41	13	54	21	20	23	21
28	18	8	7	52	3	4	14	13	21	30	23	18
29	17	52			3	28	14	31	21	39	23	15
30	17	36			3	51	14	50	21	49	23	12
31	17	19			4	14			21	57		

Third after Leap-Year.

Suns Declination 1787, 1791, 1795, 1799.

Days	July		Auguſt		Sept.		Oct.		Nov.		Dec.	
	North		North		North		South		South		South	
	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.	D.	M.
1	23	8	18	1	8	15	3	15	14	31	21	52
2	23	4	17	46	7	53	3	39	14	50	22	1
3	22	59	17	30	7	31	4	2	15	9	22	10
4	22	54	17	14	7	19	4	25	15	28	22	18
5	22	48	16	58	6	46	4	48	15	46	22	26
6	22	42	16	42	6	24	5	11	16	4	22	33
7	22	36	16	25	6	2	5	34	16	22	22	40
8	22	30	16	8	5	39	5	57	16	39	22	46
9	22	23	15	51	5	16	6	20	16	57	22	52
10	22	15	15	33	4	54	6	43	17	14	22	58
11	22	7	15	15	4	31	7	6	17	30	23	3
12	21	59	14	57	4	8	7	29	17	47	23	7
13	21	50	14	39	3	45	7	51	18	3	23	12
14	21	42	14	21	3	22	8	14	18	19	23	15
15	21	32	14	2	2	59	8	36	18	34	23	19
16	21	23	13	43	2	35	8	58	18	49	23	21
17	21	12	13	24	2	12	9	20	19	4	23	24
18	21	2	13	5	1	49	9	42	19	18	23	25
19	20	51	12	45	1	26	10	4	19	32	23	27
20	20	40	12	25	1	2	10	25	19	46	23	28
21	20	29	12	6	0	39	10	47	20	0	23	28
22	20	17	11	45	0	15	11	8	20	13	23	28
23	20	5	11	25	Sou.	8	11	29	20	25	23	27
24	19	52	11	55	0	31	11	50	20	37	23	26
25	19	39	10	44	0	55	12	11	20	49	23	25
26	19	26	10	23	1	18	12	32	21	1	23	23
27	19	13	10	2	1	42	12	52	21	12	23	20
28	18	59	9	41	2	5	13	12	21	23	23	18
29	18	45	9	20	2	29	13	32	21	33	23	14
30	18	31	8	58	2	52	13	52	21	43	23	10
31	18	16	8	37			14	12			23	6

A Deſcription of the TABLES *of the* SUN's DECLINATION.

THESE Tables are in general for Four Years; Leap-Year, Firſt, Second, and Third Year after Leap-Year, and conſequently for any Year.

Each Year (taking up two Pages) hath the firſt ſix Months of the Year on the Left-hand Page, and the laſt ſix Months are on the Right-hand Page, the Names of the Months are at the Head of each Column, and the Days of each Month in the Left-hand Column of each Page.

The firſt Table ſheweth the Sun's Declination every Day for the ſecond Year after Leap-Year, being 1786, 1790, 1794, and 1798, and takes up Pages (8 and 9): The ſecond Table is for 1787, 1791, 1795, and 1799, being the third year after Leap-Year in Pages (10) and (11): The next Table in Pages (12) (13) is for Leap-Year: The fourth Tables in Pages (14) and (15) ſheweth the Sun's Declination for the firſt Year after Leap-Year, being 1789, 1793, and 1797.

Under the Name of the Month, is the Name of the Declination either North or South, only the Column for March and September hath two Names; that is, under March is South, and againſt the 21ſt or 20th Day (according as it is Leap-Year, or 1ſt, 2d, 3d Year after) is Nor. for North; and under September is North; and againſt the 23d or 24th Day is Sou. for South; intimating that the Declination is South in March, till the 21ſt or 20th Day, and all the remaining Part of the Month it is North or Nor. in like Manner in September, it is North till the 23d or 24th Day, and from thence to the Month's End it is South or Sou.

The

The Uſe of the Tables of Declination.

TO find the Sun's Declination for any Day in any Year.

1. Seek the Year and Month, at the Head of the Table; and the Day of the Month in the Left-hand Column.

2. Then right under the Month, at the Head of the Table, and againſt the Day of the Month in the Left-hand Column, is the Sun's Declination required.

Example 1. I deſire to know the Sun's Declination for the 24th Day of April, 1786.

The Year 1786, is the ſecond Year after Leap-Year, which is in Page (8); then under April, and againſt 24 (under Days) is 13.0, with North at the Head of the Table under April; which ſheweth the Sun's Declination on the 24th of April, 1786, is 13d. 0m. North.

Example 2. What is the Sun's Declination for the 21ſt of March, 1784.

The Year 1788, being Leap-Year, is found in Page 12; then againſt the 21ſt Day, and under March, is North 0.37; ſignifying the Sun's Declination at that Time is 0d. 37m. North; the like do for any other Time.

A TABLE to Proportion the Sun's Declination to any other Meridian.

	Degrees of Longitude.	The daily Difference in Declination.											
		min 2	min 4	min 6	min 8	min 10	min 12	min 14	min 16	min 18	min 20	min 22	min 24
		m	m	m	m	m	m	m	m	m	m	m	m
West Long Dec. Incr. Add. Decr. Subt.	15	0	0	0	0	0	0	1	1	1	1	1	1
	30	0	0	0	1	1	1	1	1	1	2	2	2
	45	0	0	1	1	1	1	2	2	2	2	3	3
	60	0	0	1	1	2	2	2	3	3	3	4	4
East Long. Decli. Incr. Subt. Decr. Add.	75	0	1	1	2	2	2	3	3	4	4	5	5
	90	0	1	1	2	2	3	3	4	4	5	5	6
	105	1	1	2	2	3	3	4	5	5	6	6	7
	120	1	1	2	3	3	4	5	5	6	7	7	8
	135	1	1	2	3	4	4	5	6	7	7	8	9
	150	1	2	2	3	4	5	6	7	7	8	9	10
	165	1	2	3	4	5	5	6	7	8	9	10	11
	180	1	2	3	4	5	6	7	8	9	10	11	12

The Uſe of this TABLE of Proportion.

THE Tables of the Sun's Declination are calculated for the Meridian of *London*, and will ſerve for any Place under that Meridian; but for thoſe Places ſituate Eaſterly or Weſterly from it, the Declination muſt be proportioned according to its daily Difference in the Table, and Longitude of thoſe Places from the Meredian of *London*; for which Purpoſe this Table is uſeful, as is evident by theſe Examples.

Example

Example 1.

Admit the 10th Day of April, Anno 1786, I am in Longitude 105d. Eaſt ; I demand what Declination the Sun will have that Day in the Meridian of that Place ?

The Declination for April the 10th, in the Meridian of London is 8d. 5m. increaſing, and the daily Difference at that Time is 22m. therefore in this Table look in the Head thereof for the Number 22, or neareſt thereunto ; then look on the Left-hand of the Table for 105d. (or the neareſt thereto) the Longitude in, and in the common Angle of meeting is 6 Min. which is to be deducted from the Declination in the Meridian of London aforeſaid for 8d. 5m. and the Remainder will be the Declination for the Meridian, of the Longitude in, which is 7d. 59m. North. But if the Declination had decreaſed, as it doth here increaſe, then you muſt have added, as hereunder you may ſee.

	d.	m.
The Declination in the Meridian of London is	8 :	5N.
The proportional Minutes ſubtract ———————	0 :	6
The Decl. for the Longitude of 105d. Eaſt is—	7 :	59N
The Decl. for the Longitude of 105d. Weſt is	8 :	13

Example 2.

Admit the 10th Day of October, Anno 1788, I am in Longitude 87d. Weſt : I demand what Declination the Sun will have that Day in that Meridian ?

The daily Difference in the Table of Declination at this Time is 23m. and the proportional Part thereof by the laſt Table is 5 min. increaſing.

	d.	m.
The Declination in the Meridian of London—	7 :	0 S.
The proportional Minutes add ——— ———	0 :	5
The Declination in the Long. of 87d. Weſt is—	7 :	5 S.
The Declination for the Long. of 87d. Eaſt is——	6 :	54 S.

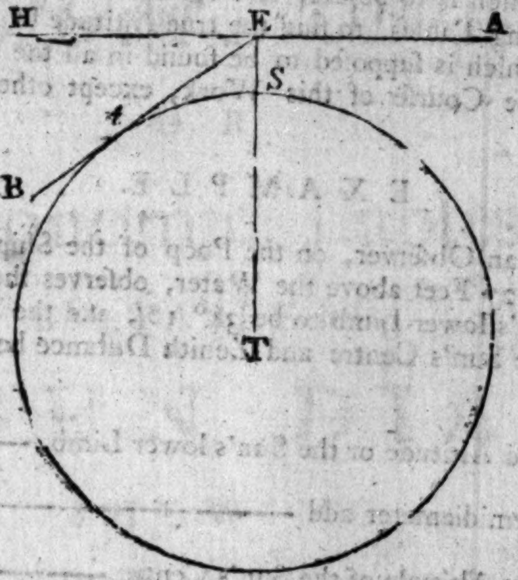
A TABLE of Refraction, deduced from the lateſt Obſervations, made at the Royal Obſervatory at Greenwich.

Alt.	Refract	Alt.	Refract	Alt.	Refract	Alt.	Refract
D.	M.S.	D.	M.S.	D.	M.S.	D.	M.S.
0	33. 0	10	5.15	25	2. 2	40	1. 8
0½	28.22	11	4.47	26	1.56	41	1. 5
1	24.29	12	4.23	27	1.51	42	1. 3
1½	19.25	13	3.57	28	1.47	43	1. 1
2	18.35	14	3.45	29	1.42	44	0.59
2½	16.26	15	3.30	30	1.38	45	0.57
3	14.36	16	3.17	31	1.35	46	0.55
3½	13. 6	17	3. 4	32	1.31	47	0.53
4	11.51	18	2.54	33	1.28	48	0.51
4½	10.48	19	2.44	34	1.24	49	0.49
5	9.54	20	2.35	35	1.21	50	0.48
6	8.28	21	2.27	36	1.18	55	0.40
7	7.20	22	2.20	37	1.16	60	0.33
8	6.29	23	2.14	38	1.13	70	0.21
9	5.48	24	2. 7	39	1.10	80	0.10
10	5.15	25	2. 2	40	1. 8	90	0. 0

The Refraction cauſeth the Sun, Moon and Stars to appear higher above the Horizon than they are; therefore the Refraction is always to be ſubtracted from the Altitude obſerved, that the true Altitude may be had as hereafter taught.

The viſible Horizon alſo differs from the true, by reaſon of the height of the Obſerver's Eye above the Surface of the Water.

Elucidation. Let the Circle following repreſent a Section of the Globe, of which T is the Center, S the Point over which the Obſerver ſtands, E the Obſerver's Eye, then will the Line HEA be the true Horizon; but the Tangent Line E t B touching the Circle in t, will be the viſible Horizon, and the angle t E H will repreſent the Dip of the Horizon, as it is called, which varies according to the Height of the Obſerver's Eye, and always to be ſubtracted from the obſerved Altitude of t Sun, Moon, or Star.



The following Table contains the Quantity of the Dip at different Heights of the Eye above the Sea.

The Eye above the Surface of the Water in Feet.	Dip of the Horizon in Minutes to be ſubtracted.
1	1
3	2
7	3
12	4
8	5
27	6
40	7

It is common to take the Altitude of the Sun's lower Limb; but if that obſcured, the upper Limb; and to allow for the Sun's Semidiameter, which may always be accounted 16 Minutes, and muſt be added to the Altitude when the lower Limb is taken, but when ſubtracted the upper Limb is taken, to find the apparent Height of the Sun's Centre, which is to be corrected for Refraction and Dip by the preceding Tables, to find the true Altitude of the Sun's Centre, which is ſuppoſed to be found in all the Examples through the Courſe of this Work, except otherwiſe expreſſed.

EXAMPLE.

Suppoſe an Obſerver, on the Poop of the Ship, and his Eye about 27 Feet above the Water, obſerves the Altitude of the Sun's lower Limb to be 34° 10′, and the true Altitude of the Sun's Centre and Zenith Diſtance be required.

	°	′
Obſerved Altitude or the Sun's lower Limb —	34	10
Sun's Semidiameter add	2	16
Apparent Altitude of the Sun's Centre	34	26
Dip for 27 Feet ſubtract	0	6
	34	20
Refraction, ſubtract nearly	0	1
True Altitude of the Sun's Centre	34	19
Which ſubtracted from	90	0
Gives the Zenith Diſtance	55	41

or the Number of Degrees the Sun is from that point in the Heavens directly over the Obſerver's Head. See Page 216.

PRIMUM MOBILE:

O R,

Aſtronomic Tables;

Each TABLE being

A SUN DIAL,

SHEWING

The exact Hour of the Day, the Sun being upon any Point of the Compaſs; fitting all Places upon the Earth and Sea, that lie between the Equator and 60 Degrees of Latitude, either North or South: And to laſt with Exactneſs as long as the Omnipotent and Everlaſting Creator ſhall be pleaſed to conſerve the great and wonderful Fabric of Nature.

A Sun-Dial for the Latitude of 0 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 0m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
North	12	12	12	12	12	12	12	12	12	12	12
wby w	Zen. Weſt	0. 2	0. 4	0. 6	0. 8	0.10	0.12	0.14	0.17	0.19	0.20
n n w		0. 4	0. 8	0.12	0.17	0.21	0.25	0.30	0.35	0.39	0.41
nw byw		0. 7	0.13	0.20	0.27	0.34	0.41	0.49	0.56	1. 3	1. 7
n w		0.10	0.20	0.30	0.41	0.51	1. 2	1.14	1.25	1.35	1.43
nw by w		0.15	0.30	0.45	1. 1	1.18	1.35	1.53	2.12	2.29	2.43
w n w		0.24	0.49	1.14	1.41	2. 9	2.41	3.18	4. 6	5.11	
w by n		0.51	1.44	2.46	4.10						
Weſt											
⊙ ſet	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0
Sun's Ampl.	d m 0. 0	d m 2.30	d m 5. 0	d m 7.30	d m 10.0	d m 12.30	d m 15.0	d m 17.30	d m 20.0	d m 22.0	d m 23.29

3½ m)

SOUTH DECLINATION.

(4 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	Zen. Weſt	0. 2	0. 4	0. 6	0. 8	0.10	0.12	0.14	0.17	0.19	0.20
s s w		0. 4	0. 8	0.12	0.17	0.21	0.25	0.30	0.35	0.39	0.41
sw by s		0. 7	0.13	0.20	0.27	0.34	0.41	0.49	0.56	1. 3	1. 7
s w		0.10	0.20	0.30	0.41	0.51	1. 2	1.14	1.25	1.35	1.43
sw by w		0.15	0.36	0.45	1. 1	1.18	1.35	1.53	2.12	2.29	2.42
w s w		0.24	0.49	1.14	1.41	2. 9	2.41	3.18	4. 6	5.11	
w by s		0.51	1.44	2.46	4. 9						
Weſt											
⊙ ſet	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0	6. 0

A Sun-Dial for the Latitude of 1 Degree.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
North	12	12	12	12	12	12	12	12	12	12	12
n by w	Zen. Weſt	0. 1	0. 3	0. 5	0. 7	0. 9	0.11	0.14	0.16	0.18	0.19
n n w		0. 2	0. 6	0.10	0.15	0.19	0.23	0.27	0.32	0.36	0.38
n wbyn		0. 4	0.11	0.17	0.24	0.31	0.38	0.46	0.53	1. 0	1. 4
n w		0. 6	0.16	0.26	0.37	0.47	0.58	1. 9	1.21	1.31	1.39
nw byw		0. 9	0.24	0.39	0.56	1.12	1.29	1.47	2. 6	2.21	2.35
w n w		0.14	0.39	1. 4	1.31	1.59	2.32	3. 7	3.54	4.53	
w by n		0.30	1.24	2.25	3.48						
Weſt											
⊙ ſet	6. 0	6. 0	6. 0	6. 0	6. 1	6. 1	6. 1	6. 1	6. 1	6. 2	6. 2
Sun's Ampl.	d m 0 .0	d m 2. 0	d m 5. 0	d m 7.30	d m 10.0	d m 12.30	d m 15.0	d m 17.30	d m 20.0	d m 22.0	d m 23.29

3½ m) **SOUTH DECLINATION.** (4 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 1	0. 3	0. 5	0. 7	0. 9	0.11	0.13	0.15	0.17	0.19	0.21
s s w	0. 2	0. 6	0.10	0.14	0.18	0.22	0.26	0.31	0.36	0.39	0.42
sw by s	0. 3	0. 9	0.16	0.23	0.3	0.37	0.41	0.51	0.59	1. 5	1.10
s w	0. 4	0.14	0.24	0.34	0.45	0.55	1. 6	1.17	1.29	1.39	1.47
sw by w	0. 6	0.21	0.36	0.51	1. 7	1.24	1.40	1.57	2.17	2.31	2.46
w s w	0.10	0.34	0.58	1.23	1.50	2.18	2.50	3.26	4.13	5.13	
w by s	0.20	1.11	2. 4	3. 5	4.28						
Weſt	6. 0										
⊙ ſet	6. 0	6. 0	6. 0	6. 0	5.59	5.59	5.59	5.59	5.59	5.58	5.58

A Sun-Dial for the Latitude of 2 Degrees.

NORTH DECLINATION.

0 d	Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23d 29m
h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
12	North	12	12	12	12	12	12	12	12	12	12
0. 2	n by w	Zen. Weſt	0. 2	0. 4	0. 6	0. 9	0.11	0.13	0.15	0.17	0.18
0. 3	n n w		0. 5	0. 9	0.13	0.18	0.22	0.27	0.23	0.35	0.38
0. 5	n wbyn		0. 8	0.15	0.22	0.29	0.36	0.44	0.51	0.57	1. 2
0. 8	n w		0.12	0.22	0.33	0.43	0.54	1. 5	1.18	1.27	1.34
0.12	nw byw		0.18	0.33	0.49	1. 5	1.22	1.40	2. 0	2.16	2.29
0.20	w n w		0.29	0.55	1.21	1.50	2.21	2.58	3.45	4.46	
0.40	w by n		1. 3	2. 3	3.22						
6. 0	Weſt										
6. 0	⊙ ſet	6. 0	6. 0	6. 0	6. 1	6. 2	6. 2	6. 2	6. 3	6. 3	6. 4
d m	Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
0. 0	Ampl.	2.30	5. 0	7.30	10.0	12.30	15.0	17.31	20.1	22.1	23.30

3½ m) **SOUTH DECLINATION.** (4 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 2	0. 4	0. 6	0. 8	0.10	0.12	0.14	0.16	0.18	0.20	0.22
s s w	0. 3	0 7	0.12	0.16	0.20	0.25	0.29	0.34	0.38	0.42	0.45
sw by s	0. 5	0.12	0.19	0.25	0.32	0.39	0.46	0.54	1. 1	1. 8	1.12
s w	0. 8	0.18	0.28	0.38	0.48	0.59	1.10	1.21	1.33	1.42	1.50
sw by w	0.12	0.27	0.42	0.57	1.13	1.29	1.46	2. 4	2.23	2.40	2.53
w s w	0.20	0.43	1. 8	1.33	2. 0	2.28	3. 1	3.36	4.24	5.24	
w by s	0.40	1.30	2.22	3.22	4.43						
Weſt	6. 0										
⊙ ſet	6. 0	6. 0	6. 0	5.59	5.59	5.58	5.58	5.58	5.57	5.57	5.56

A Sun-Dial for the Latitude of 3 Degrees.

NORTH DECLINATION.

0 d	Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
12	North	12	12	12	12	12	12	12	12	12	12
0. 2	n by w	Zen. West	0. 2	0. 4	0. 6	0. 8	0.10	0.12	0.14	0.16	0.17
0. 5	n n w		0. 3	0. 7	0.12	0.16	0.20	0.25	0.29	0.33	0.36
0. 8	nw by n		0. 5	0.12	0.19	0.26	0.33	0.40	0.48	0.54	0.59
0.12	n w		0. 8	0 18	0.29	0.39	0.50	1. 1	1.13	1.23	1.31
0.18	nw by w		0.12	0.27	0.43	0.59	1.16	1.34	1.54	2.10	2.24
0.29	w n w		0.20	0.45	1.11	1.39	2.11	2.47	3.33	4.33	
0.59	w by n		0.42	1.40	2.57						
6. 0	Weſt										
0. 0	⊙ ſet	6. 0	6. 0	6. 1	6. 2	6. 2	6. 3	6. 4	6. 4	6. 5	6. 5
d m	Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
0. 0	Ampl.	2.30	5. 0	7.30	10.1	12.31	15.1	17.31	20.2	22.2	23.32

3½m) **SOUTH DECLINATION.** (4

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 2	0. 5	0. 7	0. 9	0.11	0.13	0.15	0.17	0.19	0.21	0.22
s s w	0. 5	0. 9	0.13	0.18	0.22	0.26	0.31	0.35	0.40	0.44	0.47
sw by s	0. 8	0.15	0.21	0.28	0.35	0.42	0.49	0.56	1. 4	1.10	1.15
s w	0.12	0.22	0.32	0.42	0.53	1. 3	1.14	1.25	1.37	1.47	1.55
sw by w	0.18	0.33	0.48	1. 3	1.19	1.35	1.52	2.10	2.30	2.45	3. 0
w s w	0.29	0.53	1.17	1.42	2. 9	2.37	3. 9	3 45	4.32	5.31	
w by s	0.59	1.48	2.40	3.38	4.56						
Weſt	6. 0										
⊙ ſet	6. 0	6. 0	6. 0	5.59	5 58	5.58	5.57	5.56	5.56	5.55	5.55

A Sun-Dial for the Latitude of 4 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	Deg. Min.	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	North	12	12	12	12	12	12	12	12	12
s by w	0. 1	n by w	0. 1	0. 3	0. 5	0. 7	0. 9	0.11	0.13	0.15	0.17
s s w	0. 2	n n w	0. 2	0. 6	0.10	0.14	0.19	0.23	0.28	0.32	0.35
sw by s	0. 4	nw by n	0. 3	0. 9	0.16	0.23	0.30	0.38	0.45	0.52	0.57
s w	0. 6	n w	0. 4	0 14	0.24	0.35	0.46	0.57	1. 9	1.19	1.26
sw by w	0. 9	nwby w	0. 6	0.21	0.37	0.53	1.10	1.28	1.47	2. 4	2.17
w s w	0.14	w n w	0.10	0.35	1. 1	1.29	2. 0	2.36	3.21	4.17	
w by s	0.29	w by n	0.21	1.17	2.29						
Weſt	3.25	Weſt									
☉ ſet	6. 0	☉ ſet	6. 1	6. 2	6. 3	6. 3	6. 4	6. 5	6. 6	6. 6	6. 7
un' Amp	d m 2.30	Sun's Ampl.	d m 5. 0	d m 7.31	d m 10.1	d m 12.31	d m 15.2	d m 17.31	d m 20.3	d m 22.3	d m 23.33

3½m) SOUTH DECLINATION. (4 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 3	0. 5	0. 7	0. 9	0.11	0.13	0.16	0.18	0.20	0.22	0.23
s s w	0. 7	0.11	0.15	0.19	0.23	0.28	0.32	0.36	0.41	0.45	0.48
sw by s	0.11	0.17	0.24	0.31	0.38	0.45	0.52	0.59	1. 7	1.13	1.18
s w	0.16	0.26	0.36	0.46	0.56	1. 7	1.18	1.29	1.41	1.51	1.58
sw by w	0.24	0.39	0.54	1. 9	1.25	1.41	1.58	2.15	2.35	2.51	3. 4
w s w	0.38	1. 2	1.26	1.51	2.17	2.45	3.17	3.52	4.38	5.33	
w by s.	1.17	2. 5	2.55	3.51	5. 4						
Weſt	6. 0										
☉ ſet	6. 0	6. 0	5.59	5.58	5 57	5.57	5.56	5.55	5.54	5.54	5.53

A Sun-Dial for the Latitude of 5 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	Deg. Min.	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	North	12	12	12	12	12	12	12	12	12
s by w	0. 2	n by w	Zen. Weſt	0. 2	0. 4	0. 6	0. 8	0.10	0.12	0.14	0.16
s s w	0. 4	n n w		0. 4	0. 8	0.13	0.18	0.22	0.26	0.30	0.33
sw by s	0. 7	nw by n		0. 7	0.14	0.21	0.28	0.35	0.43	0.49	0.54
s w	0.10	n w		0.10	0.20	0.31	0.42	0.53	1.55	1.15	1.22
sw by w	0.16	nw by w		0.15	0.31	0.47	1. 4	1.21	1.40	1.57	2.10
w s w	0.24	w n w		0.25	0.51	1.18	1.49	2.24	3. 8	4. 0	
w by s	0.48	w by n		0.54	2. 1						
Weſt	4. 0	Weſt									
w by n											
⊙ ſet	6. 1	⊙ ſet	6. 2	6. 3	6. 4	6. 4	6. 5	6. 6	6. 7	[illegible]	6. [illegible]
Sun's Ampl.	d m 2.30	Sun's Ampl.	d m 5. 1	d m 7.31	d m 10.2	d m 12.32	d m 15.3	d m 17.34	d m 20.5	d m 22.5	d m 23.35

3½ m) SOUTH DECLINATION. (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 4	0. 6	0. 8	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24
s s w	0. 8	0.12	0.17	0.21	0.25	0.29	0.34	0.38	0.43	0.47	0.50
sw by s	0.13	0.20	0.27	0.33	0.40	0.47	0.54	1. 2	1. 9	1.16	1.21
s w.	0.20	0.30	0.40	0.50	1. 0	1.11	1.22	1.33	1.45	1.55	2. 2
sw by w	0.30	0.45	1. 0	1.15	1.31	1.46	2. 3	2.21	2.40	2.56	3.11
w s w	0.48	1.11	1.35	2. 0	2.26	2.53	3.24	3.59	4.43	5.37	
w by s	1 35	2.11	3. 9	4. 3	5.11						
Weſt	6. 0										
⊙ ſet	6. 0	5.59	5.58	5.57	5.56	5.56	5.55	5.54	5.53	5.52	5.51

A Sun-Dial for the Latitude of 6 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	Deg. Min.	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	North	12	12	12	12	12	12	12	12
s by w	0. 3	0. 1	n by w	0. 1	0. 3	0. 5	9. 7	0. 9	0.12	0.13	0.15
s s w	0. 6	0. 2	n n w	0. 3	0. 7	0.11	0.15	0.20	0.25	0.28	0.31
sw by s	0. 9	0. 3	nw by n	0. 4	0.11	0.18	0.25	0.32	0.40	0.46	0.51
s w	0.14	0. 4	n w	0. 6	0.16	0.27	0.38	0.49	1. 2	1.10	1.18
sw by w	0.21	0. 6	nw by w	0. 9	0.25	0.41	0.57	1.15	1.34	1.50	2. 4
w s w	0.33	0. 9	w n w	0.15	0.40	1. 8	1.38	2.12	2.55	3.44	
w by s	1. 6	0.20	w by n	0.32	1.34	3.24					
Weſt	4.22	2.15	Weſt								
☉ ſet	6. 1	6. 2	☉ ſet	6. 3	6. 4	6. 5	6. 6	6. 7	6. 9	6.10	6.11
Sun's Ampl.	d m 2.30	d m 5. 1	Sun's Ampl.	d m 7.32	d m 10.3	d m 12.34	d m 15.5	d m 17.36	d m 20.6	d m 22.7	d m 23.37

3½ m) SOUTH DECLINATION. (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 5	0. 7	0. 9	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.24
s s w	0 10	0.14	0.18	0.22	0.27	0.31	0.35	0.40	0 44	0.48	0.51
sw by s	0.16	0 23	0.29	0.36	0.43	0.50	0.57	1. 4	1.12	1.18	1.2
s w	0.24	0.34	0.44	0.54	1. 5	1.15	1.25	1.37	1.48	1.58	2. 6
sw by w	0.36	0.50	1. 5	1.20	1.36	1.52	2. 8	2.26	2.45	3. 1	3.15
w s w	0.57	1.20	1.44	2. 8	2.34	3. 1	3.31	4. 6	4.48	5.37	
w by s	1 51	2.35	3.22	4 13	5.16						
Weſt	6. 0										
☉ ſet	6. 0	5.59	5.58	5.57	5.56	5.55	5.54	5.53	5.51	5.50	5 49

A Sun-Dial for the Latitude of 7 Degrees.

NORTH DECLINATION.

Deg. Min	0 d 30m	2 d	Deg. Min.	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	Point	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	North	12	12	12	12	12	12	12	12
s by w	0. 4	0. 2	n by w	0. 0	0. 2	0. 4	0. 7	0. 9	0.11	0.13	0.14
s s w	0 7	0. 3	n n w	0. 1	0. 5	0. 9	0.14	0.18	0.23	0.27	0.30
sw by s	0.12	0. 5	nw by n	0. 1	0. 8	0.15	0.22	0.29	0.37	0.44	0.48
s w	0 18	0. 8	n w	0. 2	0.12	0.23	0.33	0.45	0.56	1. 6	1.14
sw by w	0.27	0.12	nw byw	0. 3	0.18	0.34	0.51	1. 8	1.27	1.43	1.57
w s w	0.43	0.19	w n w	0. 5	0.39	0 57	1.27	2. 0	2.42	3.28	
w by s	1.23	0.39	w by n	0.10	1. 8	2.36					
Weſt	4.37	2.58	Weſt								
⊙ ſet	6. 1	6. 2	⊙ ſet	6. 3	6. 5	6. 6	6. 8	6. 9	6.10	6.11	6.12
Sun's Ampl.	d m 2.31	d m 5. 2	Sun's Ampl.	d m 7.33	d m 10.4	d m 12.35	d m 15.7	d m 17.38	d m 20.9	d m 22.10	d m 23.4

3½ m) SOUTH DECLINATION (4 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 6	0. 7	0. 9	0.11	0.13	0.16	0.18	0.20	0.22	0.24	0.25
s s w	0.12	0.16	0.20	0.24	0.28	0.33	0.37	0.41	0.46	0.50	0.53
s w by s	0.19	0.25	0.32	0.39	0.45	0.52	0.59	1. 7	1.15	1.21	1.25
s w	0.28	0.38	0.48	0.58	1. 8	1.18	1.29	1.40	1.52	2. 2	2. 9
sw by w	0.41	0.56	1.11	1.26	1.41	1.57	2.14	2.31	2.50	3. 7	3.19
w s w	1. 6	1.29	1.52	2.16	2.41	3. 8	3.38	4.12	4.52	5.39	
w by s	2. 6	2.49	3.33	4.22	5.20						
Weſt	6. 0										
⊙ ſet	6. 0	5.59	5.58	5.57	5.55	5.54	5.52	5.51	5.50	5.49	5.48

A Sun-Dial for the Latitude of 8 Degrees.

NORTH DECLINATION.

Deg. Min	2 d 30m	5 d	7 d 30m	Deg. Min.	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	North	12	12	12	12	12	12	12
s by w	0. 4	0. 2	0. 0	n by w	0. 2	0. 4	0. 6	0. 8	0.10	0.12	0.13
s s w	0. 9	0. 5	0. 1	n n w	0. 3	0. 8	0.12	0.16	0.21	0.25	0.28
sw by s	0.15	0. 8	0. 1	nw by n	0. 5	0.12	0.20	0.27	0.3.	0.41	0.45
s w	0 22	0.12	0. 2	n w	0. 8	0.18	0.29	0.40	0.52	1. 2	1. 9
sw by w	0.33	0.18	0. 3	nw by w	0.12	0.28	0.45	1. 2	1.20	1.35	1.49
w s w	0.52	0.29	0. 5	w n w	0.20	0.46	1.16	1.48	2.28	3.11	4. 6
w by s	1.39	0.56	0.10	w by n	0.44	0.59					
West	4.48	3.26	1.22	West							
☉ ſet	6. 1	6. 3	6. 4	☉ ſet	6. 6	6. 7	6. 9	6.10	6.12	6.13	6.14
Sun's	d m	d m	d m	Sun's	d m	d m	d m	d m	d m	d m	d m
Ampl.	2.31	5. 2	7.34	Ampl.	10.6	12.38	15.9	17.40	20.12	22.10	23 40

3½ m) SOUTH DECLINATION (4 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 6	0. 8	0.10	0.12	0.14	0.16	0.18	0.21	0.2	0.25	0.26
s s w	0.13	0.17	0.21	0.26	0.30	0.34	0.38	0.43	0.47	0.51	0.54
s w by s	0.21	0.28	0.34	0.41	0.48	0.55	1. 2	1. 9	1.17	1.23	1.28
s w	0.32	0.41	0.5	1. 1	1.11	1.22	1.33	1.44	1.55	2. 5	2.13
sw by w	0.47	1. 2	1.16	1.31	1.46	2. 2	2.19	2.3	2.55	3. 9	3.22
w s w	1.14	1.37	2. 0	2.24	2.48	3.15	3.44	4.17	4.56	5.39	
w by s	2.20	3. 1	3.44	4.30	5.24						
West	6. 0										
☉ ſet	6. 0	5.59	5.57	5.56	5.54	5.53	5.51	5.50	5.4	5.47	5.46

A Sun-Dial for the Latitude of 9 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	Deg. Min.	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	North	12	12	12	12	12	12	12
s by w	0. 5	0. 3	0. 1	n by w	0. 1	0. 3	0. 5	0. 7	0. 9	0.11	0.12
s s w	0.11	0. 7	0. 3	n n w	0. 2	0. 6	0.10	0.14	0.19	0.23	0.26
sw by s	0.17	0.11	0. 4	nw by n	0. 3	0.10	0.17	0.24	0.31	0.38	0.43
s w	0.26	0.16	0. 6	n w	0. 4	0.14	0.25	0.36	0.47	0.57	1. 5
sw by w	0.38	0.24	0. 9	nw by w	0. 6	0.22	0.38	0.55	1.13	1.30	1.42
w s w	1. 0	0.38	0.14	w n w	0.10	0.36	1. 4	1.36	2.15	2.55	3.42
w by s	1.53	1.13	0.29	w by n	0.21	1.27					
Weſt	4.56	3.46	2.15	Weſt							
⊙ ſet	6. 1	6. 3	6. 4	⊙ ſet	6. 0	6. 8	6.10	6.12	6.14	6.15	6.17
Sun's	d m	d m	d m	Sun's	d m	d m	d m	d m	d m	d m	d m
Ampl.	2.31	5. 3	7.35	Ampl.	10.7	12.39	15.11	17.43	20.16	22.18	23.50

3½m) SOUTH DECLINATION. (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 7	0. 9	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.26
s s w	0.15	0.19	0.23	0.27	0.31	0.36	0.40	0.44	0.49	0.52	0.56
sw by s	0.24	0.30	0.37	0.44	0.50	0.57	1. 4	1.12	1.19	1.25	1.31
s w	0.36	0.45	0.55	1. 5	1.15	1.26	1.36	1.47	1.59	2. 9	2.16
sw by w	0.53	1. 7	1.22	1.36	1.52	2. 7	2.24	2.41	2.59	3.14	3.28
w s w	1.23	1.45	2. 8	2.31	2.55	3.21	3.50	4.22	5. 0	5.40	
w by s	2.33	3.12	3.52	4.35	5.27						
Weſt	6. 0										
⊙ ſet	6. 0	5.59	5.57	5.56	5.54	5.52	5.50	5.48	5.46	5.45	5.44

A Sun-Dial for the Latitude of 10 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	Deg. Min.	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m
South	12	12	12	12	North	12	12	12	12	12	12
s by w	0. 6	0. 4	0. 2	Zen. Weſt	n by w	0. 2	0. 4	0. 6	0. 8	0.10	0.12
s s w	0.12	0. 8	0. 4		n n w	0. 4	0. 9	0.13	0.18	0.21	0.24
sw by s	0.20	0.13	0. 7		nw by n	0. 7	0.14	0.21	0.29	0.35	0.40
s w	0.30	0.20	0.10		n w	0.10	0.21	0.32	0.43	0.53	1. 0
sw by w	0.44	0.30	0.15		nw by w	0.15	0.32	0.49	1. 6	1.23	1.35
w s w	1. 9	0.47	0.24		w n w	0.25	0.53	1.24	2. 1	2.3,	3.19
w by s	2. 7	1.28	0.47		w by n	0.59	1. 7				
Weſt	5. 3	4. 1	2.47								
⊙ ſet	6. 2	6. 4	6. 5	6. 7	⊙ ſet	6. 9	6.11	6.13	6.15	9.15	6.17
Sun's Ampl.	d m 2.32	d m 5. 0	d m 7.37	d m 10.10	Sun's Ampl.	d m 12.42	d m 15.15	d m 17.47	d m 20.20	d m 22.22	d m 23.54

3½m) SOUTH DECLINATION. (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 8	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.27
s s w	0.16	0.21	0.25	0.29	0.33	0.37	0.42	0.46	0.51	0.54	0.57
sw by s	0.26	0.33	0.40	0.46	0.53	1. 0	1. 7	1.14	1.22	1.28	1.33
s w	0.39	0.49	0.59	1. 9	1.19	1.29	1.40	1.51	2. 2	2.12	2.19
sw by w	0.58	1.13	1.27	1.42	1.57	2.12	2.28	2.45	3. 3	3.19	3.32
w s w	1.31	1.53	2.15	2.38	3. 2	3.27	3.55	4.26	5. 3	5.41	
w by s	2.44	3.22	4. 1	4.42	5.29						
Weſt	6. 0										
⊙ ſet	6. 0	5.58	5.56	5.55	5.53	5.51	5.49	5.47	5.45	5.44	5.43

A Sun-Dial for the Latitude of 11 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	Deg. Min.	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m
South	12	12	12	12	North	12	12	12	12	12	12
s by w	0. 7	0. 5	0. 3	0. 1	n by w	0. 1	0. 3	0. 5	0. 7	0. 9	0.11
s s w	0.14	0.10	0. 6	0. 2	n n w	0. 2	0. 7	0.11	0.16	0.20	0.22
sw by s	0.22	0 16	0. 9	0. 3	nw by n	0. 4	0.11	0.18	0.26	0.32	0.37
s w	0.34	0.24	0.14	0. 4	n w	0. 6	0.17	0.28	0.39	0.49	0.56
sw by w	0.50	0.35	0.21	0. 6	nw by w	0. 9	0.25	0.42	1. 0	1.15	1.28
w s w	1.17	0.56	0.33	0.10	w n w	0.15	0.41	1.12	1.47	2.23	2.59
w by s	2.19	1.43	1. 3	0.20	w by n	0.33	1.55				
Weſt	5. 8	4.13	3. 9	1.40							
⊙ ſet	6. 2	6. 4	6. 6	6. 8	⊙ ſet	6.10	6.12	6.14	6.16	6.18	6.19
Sun's Ampl.	d m 2.32	d m 5. 5	d m 7.38	d m 10.11	Sun's Ampl.	d m 12.44	d m 15.17	d m 17.50	d m 20.24	d m 22.27	d m 23.59

3½ m) SOUTH DECLINATION. (4 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 9	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.2
s s w	0.1[illegible]	0.22	0.26	0.30	0.34	0.39	0.43	0.47	0.52	0.56	0.5
s w by s	0.29	0.36	0.42	0.49	0.55	1. 2	1. 9	1.16	1.24	1.30	1.3
s w	0.43	0.53	1. 3	1.12	1.22	1.33	1.43	1.54	2. 5	2.15	2.2
sw by w	1. 4	1.18	1.32	1.47	2. 1	2.17	2.33	2.49	3. 7	3.23	3.3
w s w	1.39	2. 1	2.22	2.45	3. 8	3.33	4. 0	4.30	5. 5	5.41	
w by s	2.55	3.31	4. 8	4.47	5.31						
Weſt	6. 0										
⊙ ſet	6. 0	5.58	5.56	5.54	5.52	5.50	5.48	5.46	5.44	5.42	5.4

A Sun-Dial for the Latitude of 12 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	Deg. Min.	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m	h m
South	12	12	12	12	North	12	12	12	12	12	12
s by w	0. 7	0. 6	0. 4	0. 2	n by w	0. 0	0. 2	0. 4	0. 7	0. 9	0.10
s s w	0.16	0.12	0. 8	0. 4	n n w	0. 1	0. 5	0.10	0.14	0.18	0.21
sw by s	0.25	0.19	0.12	0. 5	nw by n	0. 1	0. 8	0.15	0.23	0.29	0.34
s w	0.37	0.28	0.18	0. 8	n w	0. 2	0.12	0.23	0.35	0.44	0.51
sw by w	0.55	0.41	0.27	0.12	nw byw	0. 3	0.19	0.35	0.53	1. 9	1.21
w s w	1.25	1. 4	0.42	0.19	w n w	0. 5	0.31	1. 0	1.34	2. 7	2.40
w by s	2.31	1.56	1.19	0.38	w by n	0.10	1.17				
Weſt	5.12	4.23	3.27	2.16							
⊙ ſet	6. 2	6. 4	6. 6	6. 9	⊙ ſet	6.11	6.13	6.15	6.18	6.20	6.21
Sun's Ampl.	d m 2.33	d m 5. 7	d m 7.40	d m 10.13	Sun's Ampl.	d m 12.48	d m 15.20	d m 17.54	d m 20.28	d m 22.31	d m 24.5

3½m) **SOUTH DECLINATION.** (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0. 9	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29
s s w	0.20	0.24	0.28	0.32	0.36	0.40	0.44	0.49	0.53	0.57	1. 0
s w by s	0.32	0.38	0.45	0.51	0.58	1. 5	1.12	1.19	1.26	1.32	1.37
s w	0.47	0.56	1. 6	1.16	1.26	1.36	1.46	1.57	2. 8	2.18	2.25
sw by w	1. 9	1.23	1.37	1.52	2. 6	2.21	2.37	2.53	3.11	3.27	3.39
w s w	1.47	2. 7	2.29	2.51	3.14	3.38	4. 4	4.33	5. 7	5.41	
w by s	3. 5	3.39	4.14	4.51	5.32						
Weſt	6. 0										
⊙ ſet	6. 0	5.58	5.56	5.54	5.51	5.49	5.47	5.45	5.42	5.40	5.39

A Sun-Dial for the Latitude of 13 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	Deg. Min.	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m
South	12	12	12	12	12	North	12	12	12	12	12
s by w	0. 8	0. 6	0. 4	0. 2	0. 0	n by w	0. 2	0. 4	0 6	0. 8	0. 9
s s w	0.17	0.13	0. 9	0. 5	0. 1	n n w	0. 3	0. 8	0.12	0.16	0.19
sw by s	0.28	0.21	0.15	0. 8	0. 1	nw by n	0. 6	0.13	0.20	0.26	0.31
s w	0.41	0.31	0.22	0.12	0. 2	n w	0. 8	0.19	0.30	0.40	0.47
sw by w	1. 1	0.47	0.32	0.18	0. 3	nw by w	0.13	0.29	0.46	1. 1	1.13
w s w	1.33	1.12	0.51	0.28	0. 5	w n w	0.21	0.49	1.21	1.52	2.22
w by s	2.41	2. 8	1.33	0.54	0.10	w by n	0.48				
Weſt	5.16	4 31	3.41	2.41	1. 6						
⊙ ſet	6. 2	6. 5	6. 7	6. 9	6.11	⊙ ſet	6.14	6 16	6.19	6.21	6.23
Sun's Ampl.	d m 2.34	d m 5. 8	d m 7.42	d m 10.16	d m 12.49	Sun's Ampl.	d m 15.24	d m 17.59	d m 20.33	d m 22.37	d m 24.1

3½m) **SOUTH DECLINATION.** (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.10	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0 29
s s w	0.21	0.25	0.29	0.33	0.38	0.42	0 46	0.50	0.55	0.59	1. 2
sw by s	0.34	0.41	0.47	0.54	1. 0	1. 7	1.14	1.21	1.28	1.34	1.39
s w	0.51	1. 0	1.10	1.19	1.29	1.39	1.50	2. 1	2.12	2.21	2.29
sw by w	1.14	1.28	1.42	1.56	2.11	2.26	2.41	2.58	3.15	3.30	3.42
w s w	1.54	2.15	2.36	2.57	3.20	3.43	4. 8	4.37	5. 9	5.40	
w by s	3.14	3.47	4.20	4.55	5.34						
Weſt	6. 0										
⊙ ſet	6. 0	5.58	5.55	5.53	5.51	5.49	5.46	5.44	5.41	5.39	5.37

A Sun-Dial for the Latitude of 14 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	Deg. Min.	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m
South	12	12	12	12	12	North	12	12	12	12	12
s by w	0. 9	0. 7	0. 5	0. 3	0. 1	n by w	0. 1	0. 3	0 5	0. 7	0. 8
s s w	0.19	0.15	0.11	0. 7	0. 3	n n w	0. 2	0 6	0 10	0.14	0.17
sw by s	0.30	0.24	0.17	0.11	0. 4	nw by n	0. 3	0.10	0 17	0.23	0.28
s w	0.45	0.35	0.26	0.16	0. 6	n w	0. 4	0.15	0 26	0.35	0.43
sw by w	1. 6	0.52	0.38	0.24	0. 9	nw by w	0. 6	0.22	0.40	0.54	1. 6
w s w	1.41	1.20	0.59	0 38	0.15	w n w	0.10	0.37	1. 8	1.38	2. 5
w by s	2.52	2.19	1.46	1.10	0.29	w by n	0.22	1.48			
Weſt	5.19	4 38	3.53	3. 0	1.49	Weſt					
⊙ ſet	6. 2	6 5	6. 7	6.10	6.12	⊙ ſet	6.15	6 18	6.21	6.23	6.25
Sun's Ampl.	d m 2.34	d m 5, 9	d m 7.44	d m 10.19	d m 12.53	Sun's Ampl.	d m 15.28	d m 18.3	d m 20.38	d m 22.43	d m 24.16

3½m) SOUTH DECLINATION. (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w.	0.11	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.30
s s w	0.23	0.27	0 31	0.35	0.39	0.44	0 48	0.52	0.57	1. 1	1. 3
sw by s	0.37	0 43	0.50	0.56	1. 3	1.10	1.16	1.23	1.31	1.36	1.41
s w	0.54	1. 4	1.13	1.23	1 33	1.43	1.53	2. 4	2.15	2.24	2.31
sw by w.	1.2[illegible]	1.33	1.47	2. 1	2.15	2.30	2.45	3. 2	3.19	3.33	3.45
w s w.	2. 1	2.21	2.42	3. 3	3.25	3.48	4.12	4.40	5.11		
w by s	3.22	3.53	4.25	4.59	5.35						
Weſt	6. 0										
⊙ ſet	6. 0	5.58	5.55	5.53	5.50	5.48	5.45	5.42	5.39	5.37	5.35

A Sun-Dial for the Latitude of 15 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	Deg. Min.	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m	h m
South	12	12	12	12	12	North	12	12	12	12	12
s by w	0.10	0. 8	0. 6	0. 4	0. 2	n by w	Zen. West.	0. 2	0. 4	0. 6	0. 7
s s w	0.21	0.16	0.12	0. 8	0. 4	n n w		0. 4	0. 9	0.12	0.15
sw by s	0.3[illegible]	0.26	0.20	0.13	0. 7	nw by n		0. 7	0.14	0.20	0.25
s w	0.49	0.39	0.30	0.20	0.10	n w		0.11	0.22	0.31	0.38
sw by w	1.11	0.58	0.44	0.30	0.15	nw by w		0.16	0. 3	0.47	0.59
w s w	1.48	1.28	1. 8	0.47	0.24	w n w		0.26	0.56	1.24	3.50
w by s	3. 0	2.30	1.58	1.24	0.46	w by n		1. 6			
West	5.22	4.44	4. 2	3.15	2.17						
⊙ ſet	6. 2	6. 5	6. 8	6.11	6.13	⊙ ſet	6.16	6.19	6.22	6.25	6.27
Sun's	d m	d m	d m	d m	d m	Sun's	d m	d m	d m	d m	d m
Ampl.	2.35	5.10	7.46	10.21	12.56	Ampl.	15.32	18.8	20.44	22.49	24.24

3½ m) SOUTH DECLINATION. (4 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.12	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.31
s s w	0.24	0.28	0.32	0.36	0.40	0.45	0.49	0.53	0.58	1. 2	1. 4
sw by s	0.39	0.46	0.52	0.59	1. 5	1.12	1.18	1.25	1.33	1.39	1.43
s w	0.58	1. 7	1.17	1.26	1.36	1.46	1.56	2. 7	2.18	2.27	2.34
sw by w	1.25	1.38	1.52	2. 6	2.20	2.34	2.49	3. 5	3.22	3.37	3.4
w s w	2. 8	2.28	2.48	3. 8	3.29	3.52	4.16	4.42	5.11		
w by s	3.30	4. 0	4.30	5. 2	5.36						
West	6. 0										
⊙ ſet	6. 0	5.58	5.55	5.52	5.49	5.47	5.44	5.41	5.38	5.35	5.33

A Sun-Dial for the Latitude of 16 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 0m	5 d	7 d 30m	10 d	12 d 30m	15 d	Deg. Min.	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m
South	12	12	12	12	12	12	North	12	12	12	12
s by w	0.11	0. 9	0. 7	0. 5	0. 3	0. 1	n by w	0. 1	0. 3	0. 5	0. 7
s s w	0.22	0.18	0.14	0.10	0. 6	0. 2	n n w	0. 3	0. 7	0.11	0.14
sw by s	0.35	0.29	0.23	0.16	0.10	0. 3	nw by n	0. 4	0.11	0.17	0.22
s w	0.52	0.43	0.34	0.24	0.14	0. 4	n w	0. 6	0.17	0.26	0.33
sw by w	1.16	1. 3	0.49	0.35	0.21	0. 6	nw by w	0.10	0.26	0.40	0.52
w s w	1.55	1.36	1.16	0.55	0.33	0.10	w n w	0.16	0.44	1.11	1.34
w by s	3. 8	2.39	2. 9	1.37	1. 2	0.20	w by n	0.36			
Weſt	5.25	4.49	4.11	3.28	2.37	1.23					
⊙ ſet	6. 3	6. 6	6. 9	6.12	6.15	6.18	⊙ ſet	6.21	6.24	6.27	6.29
Sun's	d m	d m	d m	d m	d m	d m	Sun's	d m	d m	d m	d m
Ampl.	2.36	5.12	7.48	10.24	13.0	15.37	Ampl.	18.13	20.51	22.56	24.32

3½ m) **SOUTH DECLINATION.** (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.13	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.33
s s w	0.26	0.30	0.34	0.38	0.42	0.46	0.50	0.55	0.59	1. 3	1. 6
sw by s	0.42	0.48	0.54	1. 1	1. 7	1.14	1.21	1.28	1.35	1.41	1.45
s w	1. 2	1.11	1.20	1.29	1.39	1.49	1.59	2.10	2.21	2.30	2.37
sw by w	1.30	1.43	1.56	2.10	2.24	2.38	2.53	3. 9	3.25	3.40	3.51
w s w	2.15	2.34	2.54	3.14	3.34	3.56	4.19	4.45	5.13		
w by s	3.37	4. 5	4.34	5. 4	5.36						
Weſt	6. 0										
⊙ ſet	6. 0	5.57	5.54	5.51	5.48	5.45	5.42	5.39	5.36	5.33	5.31

A Sun-Dial for the Latitude of 17 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	Deg. Min.	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m	h m
South	12	12	12	12	12	12	North	12	12	12	12
s by w	0.11	0. 9	0. 7	0. 6	0. 4	0. 2	n by w	0. 0	0. 2	0. 4	0. 6
s s w	0.24	0.20	0.16	0.12	0. 8	0. 3	n n w	0. 1	0. 5	0. 9	0.12
sw by s	0.38	0.32	0.25	0.19	0.13	0. 6	nw by n	0. 1	0. 8	0.15	0.19
s w	0.56	0.47	0.38	0.28	0.18	0. 8	n w	0. 2	0.13	0.22	0.29
sw by w	1 21	1. 8	0.55	0.41	0.27	0.12	nw by w	0. 3	0.19	0.33	0.45
w s w	2. 2	1.43	1.23	1. 3	0.42	0.19	w n w	0. 5	0.33	0.57	1.20
w by s	3.36	2.48	2.20	1.49	1.16	0.38	w by n	0.11	1.36		
Weſt	5.27	4.53	4.18	3.39	2.54	1.55					
w by n					5.55	5.11					
⊙ ſet	6. 3	6. 6	6. 9	6.12	6.15	6.19	⊙ ſet	6.22	6.25	6.28	6.31
Sun's Ampl.	d m 2.36	d m 5.13	d m 7.50	d m 10.28	d m 13.4	d m 15.42	Sun's Ampl.	d m 18.19	d m 20.57	d m 23.4	d m 24.40

3½m) SOUTH DECLINATION. (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.13	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33
s s w	0.28	0 32	0.36	0.39	0.43	0.47	0.52	0.56	1. 1	1. 4	1. 7
sw by s	0.44	0.50	0.57	1. 3	1. 9	1.16	1.23	1.30	1.37	1.43	1.47
s w	1. 5	1.14	1.24	1.33	1.42	1.51	2. 2	2.13	2.23	2.32	2.39
sw by w	1.35	1.48	2. 1	2.14	2.28	2.42	2.57	3.12	3.29	3.42	3.54
w s w	2.21	2.40	2.59	3.18	3.39	4. 0	4.22	4.47	5.14		
w by s	3.43	4.10	4.38	5. 7	5.37						
Weſt	0. 0										
⊙ ſet	6. 0	5.57	5.54	5.51	5.48	5.45	5.41	5.38	5.35	5.32	5.29

A Sun-Dial for the Latitude of 18 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	Deg. Min.	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m
South	12	12	12	2	12	12	12	North	12	12	12
s by w	0.12	0.10	0. 8	0. 6	0. 4	0. 2	0. 0	n by w	0. 2	0. 3	0. 5
s s w	0.25	0.21	0.17	0.13	0. 9	0. 5	0. 1	n n w	0. 4	0. 7	0.10
sw by s	0.40	0.44	0.28	0.21	0.15	0. 9	0. 1	nw by n	0. 6	0.12	0.16
s w	1. 0	0.50	0.41	0.32	0.22	0.12	0. 2	n w	0. 9	0.17	0.24
sw by w	1.26	1.13	1. 0	0.47	0.32	0.18	0. 3	nw by w	0.13	0.27	0.38
w s w	2. 8	1.50	1.31	1.11	0.51	0.29	0. 5	w n w	0.21	0.45	1. 6
w by s	3.23	2.57	2.29	2. 0	1.29	0.53	0.10	w by n	0.53		
Weſt	5. 9	4.57	4.24	3.49	3. 8	2.18	0.56	Weſt			
w by n					5.51	5.15	4.32				
⊙ ſet	6. 3	6. 6	6. 9	6.13	6.16	6.20	6.23	⊙ ſet	6.27	6.30	6.33
Sun's Ampl.	d m 2.37	d m 5.15	d m 7.53	d m 10.31	d m 13.9	d m 15.47	d m 18.26	Sun's Ampl	d m 21.4	d m 23.12	d m 24.49

3½m) SOUTH DECLINATION. (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.14	0.16	0.18	0.20	0.22	0.24	0.26	0.28	0.30	0.32	0.33
s s w	0.29	0.33	0.37	0.41	0.45	0.49	0.53	0.58	1. 2	1. 6	1. 8
sw by s	0.47	0.53	0.59	1. 5	1.12	1.18	1.25	1.32	1.39	1.45	1.49
s w	1. 9	1.18	1.27	1.36	1.46	1.55	2. 5	2.15	2.26	2.35	2.42
sw by w	1.39	1.52	2. 5	2.18	2.32	2.45	3. 0	3.15	3.31	3.45	3.56
w s w	2.17	2.45	3. 4	3.23	3.43	4. 3	4.25	4.49	5.15		
w by s	3.49	4.15	4.41	5. 9	5.38						
Weſt	6. 0										
⊙ ſet	6. 0	5.57	5.54	5.51	5.47	5.44	5.40	5.37	5.33	5.30	5.27

A Sun-Dial for the Latitude of 19 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	Deg. Min.	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m
South	12	12	12	12	12	12	12	North	12	12	12
s by w	0.13	0.11	0. 9	0. 7	0. 5	0. 3	0. 1	n by w	0. 1	0. 3	0. 4
s s w	0.27	0.23	0.19	0.15	0.11	0. 7	0. 3	n n w	0. 2	0. 5	0 8
sw by s	0.43	0.37	0.30	0.24	0.18	0.11	0. 5	nw by n	0. 3	0. 9	0.13
s w	1. 3	0.54	0.45	0.36	0.26	0.17	0. 7	n w	0. 4	0.13	0.20
sw by w	1.31	1.18	1. 5	0.52	0.38	0.24	0. 9	nw by w	0. 6	0.20	0.31
w s w	2.15	1.57	1.38	1.19	0.59	0.37	0.15	w n w	0.10	0.33	0.53
w by s	3.30	3. 4	2.38	2.11	1.41	1. 8	0.29	w by n	0 23		
Weſt	5.31	5. 1	4 30	3.57	3.20	2.36	1.35				
w by n					5.52	5.19	4.39				
⊙ ſet	6. 3	6. 7	6.10	6.14	6.17	6.21	6.25	⊙ ſet	6.28	6.31	6.34
Sun's Ampl.	d m 2.38	d m 5.17	d m 7.56	d m 10.35	d m 13.14	d m 15.53	d m 18.33	Sun's Ampl.	d m 21.12	d m 23.20	d m 24.58

3½ m) SOUTH DECLINATION. (4 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.15	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.30	0.32	0.34
s s w	0.31	0.35	0.38	0.42	0.46	0.50	0.54	0.59	1. 3	1. 7	1. 9
sw by s	0.49	0.55	1. 1	1. 8	1.14	1.21	1.27	1.34	1.41	1.47	1.51
s w	1.12	1.21	1.30	1.39	1.48	1.58	2. 7	2.18	2.29	2.37	2.44
sw by w	1.44	1.57	2. 9	2.23	2.36	2.49	3. 4	3.19	3.34	3.48	3.58
w s w	2.33	2.51	3. 9	3.27	3.46	4. 6	4.28	4.51	5.16		
w by s	3.54	4.19	4.44	5.10	5.39						
Weſt	6. 0										
⊙ ſet	6. 0	5.57	5.53	5.50	5.46	5.43	5.39	5.35	5.32	5.29	5.26

A Sun-Dial for the Latitude of 20 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10d	12 d 30m	15 d	17 d 30m	Deg. Min.	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m	h m
South	12	12	12	12	12	12	12	North	12	12	12
s by w	0.14	0.12	0.10	0. 8	0. 6	0. 4	0. 2	n by w	Zen. West	0. 2	0. 3
s s w	0.28	0.25	0.21	0.17	0.13	0. 9	0. 5	n n w		0. 4	0. 6
sw by s	0.45	0.39	0.32	0.2[illegible]	0.20	0.14	0. 7	nw by n		0. 6	0.10
s w	1. 7	0.58	0.49	0.40	0.30	0.21	0.11	n w		0. 9	0.16
sw by w	1.36	1.23	1.10	1.58	0.44	0.30	0.15	nw by w		0.13	0.24
w s w	2.21	2. 3	1.45	1.26	1. 7	0.46	0.24	w n w		0.22	0.40
w by s	3.36	3.11	2.45	2.20	1.52	1.21	0.45				
Weſt	5.32	5. 4	4.35	4 4	3.30	2.50	2. 0				
w by n					5.54	5.23	4.47				
☉ ſet	6. 3	6. 7	6.1:	6.15	6.18	6.22	6.26	☉ ſet	6.30	6.33	6.36
Sun's	d m	d m	d m	d m	d m	d m	d m	Sun's	d m	d m	d m
Ampl.	2.40	5.19	7.59	10.39	13.19	16.0	18.40	Ampl.	21.20	23.29	25.8

3½ m) SOUTH DECLINATION. (4 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.16	0.17	0.19	0.21	0.23	0.25	0.27	0.29	0.31	0.33	0.34
s s w	0.32	0.36	0.40	0.44	0.48	0.52	0.56	1. 0	1. 5	1. 8	1.11
sw by s	0.51	0.58	1. 4	1.10	1.16	1.23	1.29	1.36	1.43	1.49	1.53
s w	1.16	1.24	1.33	1.42	1.51	2. 1	2.10	2.20	2.31	2.40	2.47
sw by w	1.48	2. 1	2.14	2.26	2.39	2.53	3. 7	3.22	3.37	3.50	4. 0
w s w	2.38	2.56	3.13	3.31	3.50	4. 9	4.30	4.52	5.16		
w by s	3.59	4.23	4.47	5.12	5.39						
Weſt	6. 0										
☉ ſet	6. 0	5.57	5.53	5.49	5.45	5.42	5.38	5.34	5.30	5.27	5.5

A Sun-Dial for the Latitude of 21 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	Deg. Min.	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m
South	12	12	12	12	12	12	12	12	North	12	12
s by w	0.14	0.13	0.11	0. 9	0. 7	0. 5	0. 3	0. 1	n by w	0. 1	0. 2
s s w	0.30	0.26	0.22	0.18	0.14	0.10	0. 6	0. 2	n n w	0. 2	0. 4
sw by s	0.48	0.42	0.35	0.29	0.23	0.16	0.10	0. 3	nw by n	0. 3	0. 7
s w	1.10	1. 1	0.52	0.43	0.34	0.24	0.15	0. 4	n w	0. 4	0.11
sw by w	1.40	1.28	1.15	1. 3	0.49	0.36	0.21	0. 6	nw by w	0. 6	0.17
w s w	2.26	2. 9	1.52	1.34	1.15	0.53	0.33	0.10	w n w	0.11	0.28
w by s	3.41	3.18	2.54	2.29	2. 3	1.33	1. 0	0.20	w by n	0.24	
Weſt	5.34	5. 7	4.40	4.11	3.39	3. 3	2.19	1.14			
w by n					5.55	5.26	4.53	4.12			
⊙ ſet	6. 4	6 8	6.12	6.16	6.20	6.24	6.28	6.32	⊙ ſet	6.35	6.38
Sun's Ampl.	d m 2.41	d m 5.21	d m 8. 2	d m 10.43	d m 13.24	d m 16 6	d m 18.47	d m 21.29	Sun's Ampl	d m 23.29	d m 25.18

3½m) SOUTH DECLINATION. 4m)

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.16	0.18	0.29	0.22	0.24	0.26	0.28	0.30	0.32	0.34	0.35
s s w	0.34	0.38	0.42	0.45	0.49	0.54	0.58	1. 2	1. 6	1.10	1.12
sw by s	0.54	1. 0	1. 6	1.12	1.19	1 25	1.32	1.38	1.45	1.51	1.55
s w	1.19	1.28	1.37	1.46	1.54	2. 4	2.13	2.23	2.33	2.42	2.49
sw by w	1.53	2. 5	2.18	2.30	2.43	2.56	3.10	3.24	3.39	3.52	4. 2
w s w	2.43	3. 1	3.18	3.35	3.54	4.12	4.32	4.53	5.17		
w by s	4. 4	4.27	4.50	5.14	5.39						
Weſt	6. 0										
⊙ ſet	6. 0	5.56	5.52	5.48	5.44	5.40	5.36	5.32	5.28	5.25	5.22

A Sun-Dial for the Latitude of 22 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	Deg. Min.	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	Point	h m	h m
South	12	12	12	12	12	12	12	12	North	12	12
s by w	0.15	0.13	0.11	0. 9	0. 8	0. 6	0. 4	0. 2	n by w	Zen. Weſt	0. 1
s s w	0.31	0.28	0.24	0.20	0.16	0.12	0. 8	0. 4	n n w		0. 3
sw by s	0.50	0.44	0.38	0.32	0.25	0.19	0.13	0. 6	nw by n		0. 4
s w	1.14	1. 5	0.56	0.47	0.38	0.29	0.19	0. 8	n w		0. 7
sw by w	1.45	1.33	1.20	1. 8	0.55	0.41	0.27	0.13	nw by w		0.10
w s w	2.32	2.15	1.58	1.40	1.22	1. 3	0.42	0.20	w n w		0.17
w by s	3.46	3.24	2. 1	2.38	2.12	1.45	1.14	0.37			
Weſt	5.35	5.10	4.44	4.17	3.47	3.14	2.35	1.43			
w by n					5.56	5.28	4.58	4.21			
⊙ ſet	6. 4	6. 8	6.12	6.16	6.21	6.25	6.29	6.34	⊙ ſet	6.37	6.40
Sun's Ampl.	d m 2.42	d m 5.23	d m 8. 5	d m 10.48	d m 13.30	d m 16.13	d m 18.55	d m 21.39	Sun's Ampl.	d m 23.50	d m 25.29

3½ m) SOUTH DECLINATION. (4m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.17	0.19	0.21	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.35
s s w	0.35	0.39	0 43	0.47	0.50	0.55	0.59	1. 3	1. 7	1.11	1.13
sw by s	0.56	1. 2	1. 8	1.14	1.21	1.27	1.33	1 40	1.47	1 52	1.57
s w	1.22	1.31	1.40	1.49	1.58	2. 7	2.16	2.25	2.36	2.44	2.51
sw by w	1 57	2. 9	2.21	2.34	2.46	2.59	3.13	3.27	3.42	3.54	4. 4
w s w	2.49	3. 5	3.22	3.39	3.57	4.15	4.34	4.55	5.17		
w by s	4. 8	4.30	4.52	5.15	5 39						
Weſt	6. 0										
⊙ ſe			.52	5 48	5.44	5.39	5.35	5.31	5 26	5.23	5.20

A Sun-Dial for the Latitude of 23 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 3 m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	Deg. Min.	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	Point	h m
South	12	12	12	12	12	12	12	12	12	North	12
s by w	0.16	0.14	0.12	0.11	0. 9	0. 7	0. 5	0. 3	0. 1	n by w	0. 0
s s w	0.33	0.30	0.26	0.22	0.18	0.14	0.10	0. 5	0. 2	n n w	0. 1
sw by s	0.53	0.47	0.41	0.34	0.28	0.22	0.16	0. 9	0. 3	nw by n	0. 1
s w	1.17	1. 8	1 0	0.50	0.41	0.32	.23	0.13	0. 4	n w	0. 2
sw by w	1.49	1.37	1.25	1.13	1. 0	0.47	0.3	0.19	0. 6	nwbyw	0. 3
w s w	2.37	2.21	2. 4	1.47	1.29	1.11	0.51	0.29	0.10	w n w	0. 6
w by s	3.51	3.30	3. 8	2.45	2.21	1.55	1.26	0.54	0.20		
Weſt	5.36	5 12	4.48	4.22	3.54	3.23	2.48	2. 4	1.11		
w by n				6.21	5.57	5.31	4. 2	4.29	3.56		
⊙ ſet	6. 4	6 9	6.13	6.17	6.22	6.26	6.31	6.36	6.39	⊙ ſet	6.42
Sun's Ampl.	d m 2.42	d m 5.26	d m 8.10	d m 10.52	d m 13.36	d m 16.20	d m 19.4	d m 21.49	d m 24.1	Sun's Ampl.	d m 25.41

4m) SOUTH DECLINATION. 4½m)

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.18	0.20	0.22	0.24	0.26	0.28	0.29	0.31	0.33	0.35	0.36
s s w	0.37	0.41	0.44	0.48	0.51	0.56	1. 0	1. 4	1. 8	1.12	1.15
sw by s	0.59	1. 4	1.10	1.16	1.23	1 29	1.35	1.42	1.49	1.54	1.59
s w	1.25	1.34	1.43	1.51	2. 1	2.10	2.19	2.28	2.38	2.46	2.53
sw by w	2. 1	2.13	2.25	2.37	2.50	3. 2	3.16	3.29	3.44	3.56	4. 6
w s w	2.53	3.10	3.26	3.43	4. 0	4.17	4.36	4.56	5.17		
w by s	4.12	4.33	4.54	5.16	5.39						
Weſt	6. 0										
⊙ ſet	6. 0	5.56	5.51	5.47	5.43	5.38	5.34	5.29	5.24	5.21	5.18

A Sun-Dial for the Latitude of 24 Degrees.

NORTH DECLINATION.

Deg. Min.	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12
s by w	0.17	0.15	0.13	0.11	0. 9	0. 8	0. 6	0. 4	0. 2	0. 0
s s w	0.35	0.31	0.27	0.23	0.19	0.15	0.11	0. 7	0. 4	0. 1
sw by s	0.55	0.49	0.43	0.37	0.30	0.24	0.18	0.11	0 6	0. 1
s w	1.20	1.12	1. 3	0.53	0.44	0.35	0.27	0.17	0. 9	0. 2
sw byw	1.54	1.42	1.30	1.18	1. 5	0.52	0.39	0.24	0.13	0. 3
w s w	2.42	2.26	2.10	1.53	1.36	1.18	0.59	0.38	0.20	0. 5
w by s	3.56	3.35	3.14	2.52	2.29	2. 5	1.38	1. 7	0.38	0.10
Weſt	5.37	5.15	4.51	4.27	4. 1	3.32	3. 0	2.21	1.39	0.50
				6.21	5.58	5.33	5. 6	4.35	4. 6	3.39
									6.24	6. 9
☉ ſet	6. 4	6. 9	6.13	6.18	6.23	6.27	6.32	6.37	6.41	6.44
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	2.44	5.28	8.13	10.57	13.42	16.27	19.13	21.59	24.12	25.54

4 m) SOUTH DECLINATION. (4½m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.18	0.20	0.22	0.24	0.26	0.28	0.29	0.31	0.33	0.35	0.37
s s w	0.38	0.42	0.46	0.50	0.53	0.57	1. 1	1. 5	1.10	1.13	1.16
sw by s	0. 1	1. 7	1.13	1.19	1.25	1.31	1.37	1 44	1.50	1 56	2. 0
s w	1.29	1.37	1.46	1.54	2. 4	2.13	2.21	2.31	2.40	2.48	2.55
sw by w	1. 5	2.17	2.29	2.41	2.53	3. 5	3.18	3.32	3.46	3.58	4. 8
w s w	2.58	3.14	3.30	3.46	4. 2	4.20	4.38	4.57	5.18		
w by s	4.16	4.36	4.56	5.17	5 39						
Weſt	6. 0										
☉ ſet	6. 0	5.56	5.51	5 47	5.42	5.37	5.33	5.28	5.23	5.19	5.16

A Sun-Dial for the Latitude of 25 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.19	0.17	0.16	0.14	0.12	0.10	0. 8	0. 6	0. 4	0. 2	0. 1
s s w	0.40	0.36	0.32	0.29	0.25	0.21	0.17	0.13	0. 9	0. 5	0. 3
sw by s	1. 3	0.57	0.51	0.45	0.39	0.33	0.27	0.21	0.14	0 9	0. 4
s w	1.32	1.23	1.15	1. 6	0.57	0.49	0.40	0.31	0.21	0.13	0. 6
sw by w	2. 9	1.58	1.46	1.35	1.22	1.10	0.58	0.44	0.31	0.19	0.10
w s w	3. 2	2.47	2.32	2.16	2. 0	1.43	1.25	1. 7	0.47	0.29	0.15
w by s	4.19	4. 0	3.40	3.20	2.59	2.37	2.14	1.48	1.19	0.53	0.29
Weſt	6. 0	5.38	4.17	4.54	4.31	4. 6	3.40	3.10	2.35	2. 0	1.24
w by n					6.21	5.59	5.36	5.10	4.41	4.14	3.50
w n w										6.25	6.10
⊙ ſet	6. 0	6. 5	6. 9	6.14	6.19	6.24	6.29	6.34	6.39	6 43	6.47
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	2.45	5.31	8.16	11.3	13.49	16.35	19.22	22.10	24.24	26.8

4 m) **SOUTH DECLINATION.** (4½ m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.19	0.21	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.36	0.37
s s w	0.40	0.43	0.47	0.51	0.55	0.59	1. 2	1. 6	1.10	1.14	1.17
sw by s	1. 3	1. 9	1.15	1.21	1.27	1.33	1.39	1.46	1.52	1.58	2. 2
s w	1.32	1.40	1.48	1.57	2. 6	2.15	2.23	2.33	2.42	2.50	2.57
sw by w	2. 9	2.21	2.32	2.44	2.56	3. 8	3.21	3.34	3.48	4. 0	4. 9
w s w	3. 2	3.18	3.33	3.49	4. 5	4.22	4.39	4.58	5.19		
w by s	4.19	4.39	4.58	5.18	5.39						
Weſt	6. 0										
⊙ ſet	6. 0	5.55	5.51	5.46	5.41	5.36	5.31	5.26	5.21	5.17	5.13

A Sun-Dial for the Latitude of 26 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.20	0.18	0.16	0.14	0.13	0.11	0. 9	0. 7	0. 5	0. 3	0. 2
s s w	0.41	0.38	0.34	0.30	0.26	0.23	0.19	0.15	0.11	0. 7	0. 4
sw by s	1. 5	0.59	0.54	0.48	0.42	0.36	0.30	0.24	0.17	0.11	0. 7
s w	1.35	1.26	1.18	1.10	0. 1	0.52	0.45	0.34	0.25	0.17	0.11
sw by w	2.13	2. 2	1.50	1.39	1.27	1.15	1. 3	0.50	0.36	0.25	0.16
w s w	3. 7	2.52	2.37	2.21	2. 6	1.49	1.32	1.14	0.55	0.38	0.25
w by s	4.22	4. 4	3.45	3.25	3.63	2.46	2.23	1.58	1.31	1. 7	0.45
Weſt	6. 0	5.39	5.19	4.57	4.35	4.12	3.47	3.19	2.47	2.16	1.47
w by n					6.21	6. 0	5.38	5.13	4.46	4.22	4. 0
w n w									6.42	6.25	6.12
☉ ſet	6. 0	6. 5	6,10	6.15	6.20	6.25	6.30	6.35	6.41	6.45	6.49
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	6. 0	2.46	5.33	8.21	11.8	13.56	16.44	19.33	22.22	24.37	26.23

4m) SOUTH DECLINATION. (4½ m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.20	0.22	0.24	0.25	0.27	0.29	0.31	0.33	0.35	0.36	0.38
s s w	0.41	0.45	0.49	0.52	0.56	1. 0	1. 4	1. 8	1.12	1.15	1.18
sw by s	1. 5	1.11	1.17	1.23	1.29	1.35	1.41	1.47	1.54	1.59	2. 3
s w	1.35	1.43	1.51	2. 0	2. 8	2.17	2.26	2.25	2.44	2.52	2.59
sw by w	2.13	2.24	2.39	2.47	2.35	3.11	3.23	3.36	3.50	4. 1	4.10
w s w	3. 7	3.21	3.37	3.52	4. 8	4.24	4.41	4.59	5.18		
w by s.	4.22	4.41	5. 0	5.19	5.39						
Weſt	6. 0										
☉ ſet	6. 0	5.55	5.50	5.45	5 40	5.35	5.30	5.25	5.19	5.15	5.11

A Sun-Dial for the Latitude of 27 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.21	0.19	0.17	0.15	0.13	0.12	0.10	0. 8	0. 6	0. 4	0. 3
s s w	0.43	0.39	0.35	0.32	0.28	0.24	0.20	0.17	0.12	0. 9	0. 6
sw by s	1. 7	1. 2	0.56	0 50	0.45	0.39	0.33	0.27	0.20	0.13	0.10
s w	1.38	1.30	1.21	1.13	1. 5	1.55	9.47	0.38	0.29	0.21	0.15
sw byw	2.17	2, 6	1.55	1.43	1.32	1.20	1. 8	0.55	0.42	0.32	0.23
w s w	3.10	2.56	2.41	2 26	2.11	1.55	1.39	1.22	1. 3	0.47	0.34
w by s	4.25	4. 7	3.49	3.31	3.11	2.51	2.31	2. 7	1.42	1.19	0.59
Weſt	6. 0	5 40	5.21	5. 0	4.39	4.17	3.53	3.27	2.58	2.30	2. 5
w by n					6.21	6. 1	5.39	5.17	4.51	4.28	4. 9
w n w									6.42	6.26	6.13
☉ ſet	6. 0	6, 5	6.10	6.15	6.21	6.26	6.31	6.37	6.43	6.48	6.51
Sun's Ampl.	d m 0. 0	d m 2.48	d m 5.37	d m 8.25	d m 11.14	d m 14.3	d m 16.53	d m 19.43	d m 22.34	d m 24.51	d m 26.37

4m) SOUTH DECLINATION. (4½m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.21	0.12	0.24	0.26	0.28	0.30	0.32	0.34	0.36	0.37	0.38
s s w	0.43	0.46	0.50	0.53	0.57	1. 1	1. 5	1. 9	1.13	1.16	1.19
sw by s	1, 7	1.13	1.19	1.25	1.30	1.36	1.42	1.48	1.54	2. 1	2. 5
s w	1.38	1.46	1.54	2. 2	2.11	2.19	2.28	2.37	2.46	2.54	3. 0
sw by w	2.17	2.28	2.39	2.50	3. 2	3.13	3.26	3.38	3.52	4. 2	4.10
w s w	3.10	3.25	3.40	3.54	4.10	4.25	4.42	4.59	5.18		
w by s	4.25	4.43	5. 2	5.20	5.39						
Weſt	6. 0										
☉ ſet	6. 0	5.55	5.50	5.45	5.39	5.34	5.29	5.23	5.17	5.12	5. 9

A Sun-Dial for the Latitude of 28 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.21	0.20	0.18	0.16	0.14	0.13	0.11	0. 9	0. 7	0. 5	0. 4
s s w	0.44	0.40	0.3	0.33	0.30	0.26	0.22	0.18	0.14	0.11	0. 8
sw by s	1.10	1. 4	0.58	0.53	0.47	0.41	0.35	0.29	0.22	0.16	0.13
s w	1.41	1.33	1.25	1.17	1. 8	1. 0	0.51	0.42	0.33	0.25	0.19
sw by w	2.20	2.10	1.59	1.48	1.36	1.25	1.13	1. 1	0.48	0.37	0.28
w s w	3.14	3. 0	2.46	2.31	2.17	2. 1	1.43	2.28	1.11	0.55	0.43
w by s	4.28	4.11	3.53	3.36	3.17	2.58	2.38	2.16	1.52	1.31	1.13
Weſt	6. 0	5.41	5.22	5. 3	4.43	4.21	3.59	3.35	3. 7	2.42	1.20
w by n					6.21	6. 2	5.41	5.20	4.56	4.34	4.16
w n w									6.42	6.27	6.14
⊙ ſet	6. 0	6. 5	6.11	6.16	6.22	6.2-	6.33	6.39	6.45	6.50	6.53
Sun's Ampl.	d m 0 .0	d m 2.50	d m 5.40	d m 8.30	d m 11.21	d m 14.11	d m 17.3	d m 19.54	d m 22.48	d m 25.6	d m 26.52

4 m) SOUTH DECLINATION. ($4\frac{1}{2}$ m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.21	0.22	0.25	0.27	0.28	0.30	0.32	0.34	0.36	0.38	0.39
s s w	0.44	0 48	0.51	0.55	0.58	1. 2	1. 6	1.10	1.14	1.17	1.20
sw by s	1.10	1.15	1.21	1.27	1.32	1.38	1.44	1.51	1.57	2. 3	2. 6
s w	1.41	1.49	1.57	2. 5	2.1	2.21	2.30	2.39	2.47	2.56	3. 2
sw by w	2.20	2.31	2.42	2.53	3. 4	3.10	3.28	3.40	.53	4. 4	4.13
w s w	3.14	3.28	3.43	3.57	4.12	4.27	4.44	5. 0	5.18		
w by s	4.28	4.45	5. 3	5.21	5.39						
Weſt	6. 0										
⊙ ſet	6. 0	5.55	5.49	5.41	5.38	5.33	5.27	5.21	5.15	5.10	5. 7

A Sun-Dial for the Latitude of 29 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.22	0.20	0.19	0.17	0.15	0.13	0.11	0.10	0. 8	0. 6	0. 5
s s w	0.45	0.42	0.38	0.35	0.31	0.27	0.23	0.19	0.16	0.12	0.10
sw by s	1.12	1. 6	1. 1	0 55	0.49	0.43	0.37	0.31	0.25	0.20	0.16
s w	1.43	1.36	1.28	1.20	1.12	1. 3	0.55	0.46	0.37	0.29	0.23
sw by w	2.23	2.13	2. 3	1.52	1.41	1.30	1.18	1. 6	0.53	0.42	0.34
w s w	3.18	3. 4	2.50	2.36	2.22	2. 7	1.52	1.35	1.18	1. 3	0.51
w by s	4.31	4.14	3.57	3.40	3.22	3. 5	2.45	2.24	2. 1	1.41	1.24
Weſt	6. 0	5 42	5.24	5. 5	4.46	4.26	4. 4	3.41	3.16	2.53	2.33
w by n					5.21	6. 2	5.43	5.22	5. 0	4.40	4.23
w n w									6.42	6.27	6.15
⊙ ſet	6. 0	6. 6	6.11	6.17	6.23	6.28	6.34	6.40	6.47	6.52	6.55
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	2.51	5.43	8.35	11.27	14.19	17.12	20.6	23.2	25.22	27.8

4m) **SOUTH DECLINATION.** (4½m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.22	0 24	0.26	0.27	0.29	0.31	0.33	0.35	0.37	0.38	0.39
s s w	0.45	0.49	0.53	0.56	1. 0	1. 4	1. 8	1.11	1.15	1.18	1.21
sw by s	1.12	1.17	1.23	1.29	1.34	1.40	1.46	1.52	1.59	2. 4	2. 8
s w	1.43	1.51	1.59	2. 7	2.15	2.24	2.32	2.41	2.49	2.58	3. 4
sw by w	2.23	2.34	2.45	2.56	3. 7	3.18	3.30	3.42	3.55	4. 5	4.14
w s w	3.18	3.32	3.46	4. 0	4.14	4.29	4.44	5. 0			
w by s	4.31	4.48	5. 4	5.22	5.39						
Weſt	6. 0										
⊙ ſet	6. 0	5.54	5.49	5.43	5.37	5.32	5.26	5.20	5.13	5. 8	5. 5

A Sun-Dial for the Latitude of 30 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.21	0.19	0.18	0.16	0.14	0.12	0.10	0.38	0. 7	0. 6
s s w	0.47	0.43	0.40	0.36	0.33	0.29	0.25	0.21	0.17	0.14	0.12
sw by s	1.14	1. 8	1. 3	0.58	0.52	0.46	0.40	0.34	0.28	0.23	0.19
s w	1.46	1.38	1.31	1.23	1.15	1. 7	0.58	0.50	0.41	0.33	0.27
sw byw	2.27	2.17	2. 6	1.56	1.45	1.34	1.23	1.11	0.58	0.48	0.40
w s w	3.21	3. 8	2.55	2.41	2.27	2.13	1.58	1.42	1.25	1.11	0.59
w by s	4.33	4.17	4. 1	3.44	3.27	3.10	2.51	2.31	2.10	1.51	1.35
Weſt	6. 0	5.43	5.25	5. 7	4.49	4.30	4. 9	3.48	3.24	2. 2	2.44
w by n					6.21	6. 3	4.55	5.25	4. 3	4.45	4.29
w n w									6.42	6.28	6.17
⊙ ſet	6. 0	6. 6	6.12	6.18	6.23	6.29	6.36	6.42	6.48	6.54	6.58
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0 .0	2.53	5.46	8.40	11.34	14.28	17.23	20.18	23.16	25.38	27.25

4 m) **SOUTH DECLINATION.** (4½ m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.24	0.26	0.28	0.30	0.31	0.33	0.35	0.37	0.39	0.40
s s w	0.47	0 50	0.54	0.57	0. 1	1. 5	1. 9	1.12	1.16	1.19	1.22
sw by s	1.14	1.19	1.25	1.30	1.36	1.42	1.48	1.54	2. 0	2. 5	2. 9
s w	1.46	1.54	2. 2	2.10	2.18	2.26	2.34	2.42	2.50	2.59	3. 5
sw by w	2.27	2.38	2.48	2.58	3. 9	3.20	3.32	3.44	3.56	4. 6	4.14
w s w	3.21	3.35	3.48	4. 2	4.16	4.30	4.45	5. 1			
w by s	4.33	4.49	5. 5	5.22	5.39						
Weſt	6. 0										
⊙ ſet	6. 0	5.54	5.48	5.42	5.37	5.31	5.24	5.18	5.12	5. 6	5. 2

A Sun-Dial for the Latitude of 31 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.22	0.20	0.18	0.17	0.15	0.13	0.11	0. 9	0. 8	0. 7
s s w	0.48	0.45	0.41	0.38	0.34	0.31	0.27	0.23	0.19	0.16	0.13
sw by s	1.16	1.11	1. 5	1. 0	0.54	0.48	0.43	0.37	0.31	0.25	0.21
s w	1.49	1.41	1.34	1.26	1.18	1.10	1. 2	0.53	0.45	0.37	0.32
sw by w	2.30	2.20	2.10	2. 0	1.49	1.38	1.27	1.16	1. 4	0.54	0.46
w s w	3.25	3.12	2.59	2.45	2.32	2.18	2. 3	1.48	1.32	1.18	1. 7
w by s	4.36	4.20	4. 4	3.48	3.32	3.15	2.57	2.38	2.18	2. 0	1.46
Weſt	5. 0	5.43	5.26	5. 9	4.52	4.33	4.14	3.53	3.11	3.11	2.55
w by n					6.21	6. 4	5.46	5.27	5. 7	4.49	4.35
w n w									6.43	6.2)	6.18
☉ ſet	6. 0	6. 6	6.12	6.18	6.24	6.31	6.37	6.44	6.51	6.56	7. 1
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0. 0	2.55	5.50	8.46	11.41	14.37	17.34	20.31	13.31	25.55	27.43

4m) SOUTH DECLINATION. (4½m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.23	0.25	0.27	0.28	0.30	0.32	0.34	0.36	0.38	0.39	0.40
s s w	0.48	0.52	0.55	1.59	1. 2	1. 6	1.10	1.13	1.17	1.2[illegible]	1.23
sw by s	1.16	1.51	1.27	1.32	1.38	1.44	1.49	1.54	2. 1	2. 7	2.11
s w	1.49	1.57	2. 4	2.12	2.20	2.28	2.36	2.45	2.52	3. 1	3. 6
sw by w	2:30	2.41	2.51	3. 1	3.12	3.23	3.34	3.45	3.57	4. 7	4.15
w s w	3.25	3.38	3.51	4. 4	4.18	4.32	4.46	5. 1			
w by s	4.36	4.50	5. 7	5.23							
Weſt	6. 0										
☉ ſet	6. 0	5.54	5.48	5.42	5.36	5.29	5.23	5.16	5. 9	5. 4	4.59

A Sun-Dial for the Latitude of 32 Degrees.

NORTH DECLINATION.

Deg. Min	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.24	0.22	0.21	0.19	0.17	0.16	0.14	0.12	0.10	0. 9	0. 7
s s w	0.50	0 46	0.43	0.39	0.36	0.32	0.29	0.25	0.21	0.18	0.15
sw by s	1.18	1.13	1. 7	1. 2	0.56	0.51	0.45	0.39	0.33	0.28	0.24
s w	1.52	1.44	1.37	1.29	1.22	1.14	1. 5	0.57	0.49	0.41	0.36
sw by w	2.34	2.24	2.14	2. 4	1.54	1.43	1.32	1.21	1. 9	0.59	0.51
w s w	3.28	3.15	3. 3	2.50	2.37	2.23	2. 9	1.54	1.39	1.25	1.15
w by s	4.38	4.23	4. 8	3.52	3.37	3.20	3. 3	2.45	2.26	2. 9	1.55
Weſt	6. 0	5.44	5.28	5.11	4.55	4.37	4.19	3.59	3.38	3.19	3. 4
w by n					6.21	6. 5	5.48	5.30	5.10	4.53	4.39
w n w									6.43	6.30	6.19
⊙ ſet	6. 0	6. 6	6.13	6.19	6.25	6.32	6.39	6.46	6.53	6.58	7. 3
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	2.57	5.54	8.51	11.48	14.47	17.46	20.45	23.47	26.13	28.3

4 m)

SOUTH DECLINATION.

(4½ m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.24	0.26	0.27	0.29	0.31	0.32	0.34	0.36	0.38	0.40	0.41
s s w	0.50	0.53	0.56	1. 0	1. 3	1. 7	1.11	1.14	1.18	1.21	1.24
s w by s	1.18	1.23	1.29	1.34	1.40	1.45	1.50	1.57	2. 3	2. 8	2.12
s w	1.52	1.59	2. 7	2.14	2.22	2.30	2.38	2.47	2.54	3. 2	3. 8
sw by w	2.34	2.44	2.51	3. 4	3.14	3.25	3.35	3.47	3.59	4. 8	4.16
w s w	3.28	3.41	3.53	4. 6	4.19	4.33	4.47	5. 2			
w by s	4.38	4.53	5. 8	5.23							
Weſt	6. 0										
⊙ ſet	6. 0	5.54	5.47	5.41	5.35	5.28	5.21	5.14	5. 7	5. 2	4.57

A Sun-Dial for the Latitude of 33 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.23	0.21	0.20	0.18	0.16	0.15	0.13	0.11	0. 9	0. 8
s s w	0.51	0.47	0.44	0.41	0.37	0.34	0.30	0.27	0.23	0.19	0.17
sw by s	1.20	1.15	1. 9	1. 4	0.59	0.53	0.48	0.42	0.36	0.31	0.27
s w	1.54	1.47	1.40	1.32	1.25	1.17	1. 9	1. 1	0 53	0.46	0.40
sw by w	2.37	2.27	2.17	2. 7	1.57	1.47	1.36	1.25	1.14	1. 4	0.57
w s w	3.31	3.19	3. 6	2.54	2.41	2.28	2.14	2. 0	1.45	1.32	1.22
w by s	4.40	4.25	4.11	3.56	3.41	3.25	3. 9	2.51	2.33	2.17	2. 4
Weſt	6. 0	5.45	5. 9	5.13	4.57	4.40	4.23	4. 4	3.44	3.26	3.12
w by n					6.21	6. 5	5.49	5.32	5.13	4.57	4.44
w n w									6.43	6.30	6.20
⊙ ſet	6. 0	6. 7	6.13	6.20	6.26	6.33	6.40	6.47	6.55	7. 1	7. 6
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	2.59	5.57	8.57	11.55	14.57	17.58	21.0	24.4	26.32	28.23

4m) SOUTH DECLINATION. (4½m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.26	0.28	0.30	0.31	0.33	0.35	0.37	0.39	0.40	0.41
s s w	0.51	0.54	0.58	1. 1	1. 5	1. 8	1.12	1.15	1.19	1.22	1.25
sw by s	1.20	1.25	1.30	1.36	1.41	1.47	1.52	1.58	2. 4	2. 9	2.13
s w	1.54	2. 2	2. 9	2.17	2.24	2.32	2.40	2.48	2.56	3. 4	3.10
sw by w	2.37	2.46	2.56	3. 6	3.16	3.27	3.37	3.48	4. 0	4. 9	4.17
w s w	3.31	3.43	3.56	4. 8	4.21	4.34	4.48	5. 2			
w by s	4.40	4.54	5. 9	5.24							
Weſt	6. 0										
⊙ ſet	6. 0	5.53	5.47	5.40	5.34	5.27	5.20	5.13	5. 5	4.59	4.54

A Sun-Dial for the Latitude of 34 Degrees.

NORTH DECLINATION.

Deg. Min	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.24	0.22	0.20	0.19	0.17	0.15	0.14	0.12	0.10	0. 9
s s w	0.52	0.49	0.45	0.42	0.39	0.35	0.32	0.28	0.24	0.21	0.19
sw by s	1.22	1.17	1.12	1. 7	1. 1	0.56	0.50	0.44	0.38	0.34	0.30
s w	1.57	1 50	1.42	1.35	1.28	1.20	1.12	1. 4	0.56	0.49	0.44
sw by w	2.40	2.30	2.21	2.11	2. 1	1.51	1.41	1.30	1.19	1. 9	1. 2
w s w	3.34	3.22	3.10	2.58	2.45	2.33	2.19	1. 6	1.51	1.39	1.29
w by s	4.42	4.28	4.14	3.59	3.45	3.30	3.14	2.57	2.40	2.24	2.12
Weſt	6.30	5.45	5.30	5.15	5. 0	4.43	4.26	4. 9	3.49	3.33	3.19
w by n					6.21	6. 6	5.59	5.34	5.16	5.13	4.49
w n w									6.43	6.31	6.22
⊙ ſet	6. 0	6. 7	6.14	6.20	6.27	6.34	6.42	6.49	6.57	7. 3	7. 8
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	3. 1	6. 2	9. 3	12.4	15.8	18.11	21.16	24.22	26.52	28.44

4 m) SOUTH DECLINATION. (4½ m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.25	0.27	0.29	0.30	0.32	0.34	0.35	0.37	0.39	0.41	0.42
s s w	0.52	0.55	0.59	1. 2	1. 6	1. 9	1.13	1.16	1.20	1.23	1.26
s w by s	1.22	1.27	1.32	1.38	1.43	1.48	1.54	1.10	2. 5	2.10	2.14
s w	1.57	2. 4	2.11	2.19	2.26	2.34	2.42	2.50	2.57	3. 5	3.10
sw by w	2.40	2.49	2.59	3. 9	3.18	3.28	3.39	3.50	4. 1	4.10	4.18
w s w	3.34	3.46	3.58	4.10	4.22	4.35	4.48	5. 0			
w by s	4.42	4.56	5.10	5.24							
Weſt	6. 0										
⊙ ſet	5. 0	5.53	5.46	5.40	5.33	5.26	5.18	5.11	5. 3	4.57	4.52

A Sun-Dial for the Latitude of 35 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.26	0.24	0.23	0.21	0.19	0.18	0.16	0.14	0.13	0.11	0.10
s s w	0.53	0.59	0.47	0.44	0.40	0.37	0.33	0.30	0.26	0.23	0.20
sw by s	1.24	1.19	1.14	1. 9	1.33	0.58	0.52	0.47	0.41	0.36	0.32
s w	1.59	1.52	1.45	1.38	1.31	1.23	1.15	1. 8	0.59	0.53	0.47
sw by w	2.43	2.33	2.24	2.14	2. 5	1.55	1.45	1.34	1.23	1.14	1. 7
w s w	3.37	3.25	3.13	3. 2	2.50	2.37	2.24	2.11	1.57	1.45	1.36
w by s	4.43	4.30	4.16	4. 3	3.48	3.34	3.19	3. 3	2.46	2.31	2.20
Weſt	6. 0	5.46	5.31	5.17	5. 2	4.46	4.30	4.13	3.55	3.39	3.26
w by n					6.21	6. 7	5.52	5.36	5.19	5. 5	4.53
w n w									6.44	6.31	6.22
⊙ ſet	6. 0	6. 7	6.14	6.21	6.28	6.35	6.43	6.51	6.59	7 6	7.11
Sun's Ampl.	d m 0. 0	d m 3. 3	d m 6. 6	d m 9.10	d m 12.12	d m 15.19	d m 18.25	d m 21.32	d m 24.41	d m 27.13	d m 29.5

4 m) SOUTH DECLINATION. (4½m

Deg. Min.	0 d	2 d 30m	5d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.26	0.28	0.29	0.31	0.33	0.34	0.36	0.38	0.40	0.41	0.42
s s w	0.53	0.57	1. 0	1. 4	1. 7	1.10	1.14	1.17	1.21	1.24	1.27
sw by s	1.24	1.29	1.34	1.39	1.45	1.50	1.55	2. 1	2. 7	2.12	2.1
s w	1.59	2. 6	2.14	2.21	2.28	2.36	2.43	2.51	2.59	3. 6	3.11
sw by w	2.43	2.52	2. 1	3.11	3.20	3.30	3.40	3.51	4. 2	4.11	4.18
w s w	3.37	3.48	3. 0	4.12	4.24	4.36	4.49	5. 2			
w by s	4.43	4.57	5.11	5.24							
Weſt	6. 6										
⊙ ſet	6. 0	5.53	5.46	5.39	5.32	5.25	5.17	5. 9	5. 1	4.54	4.49

A Sun-Dial for the Latitude of 36 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.27	0.25	0.23	0.22	0.20	0.19	0.17	0.15	0.13	0.12	0.11
s s w	0.55	0.51	0.48	0.45	0.42	0.38	0.35	0.31	0.28	0.24	0.22
sw by s	1.26	1.21	1.16	1.11	1. 5	1. 0	0.55	0.49	0.41	0.39	0.35
s w	2. 2	1.55	1.48	1.41	1.34	1.26	1.19	1.11	1. 3	0 56	0.51
sw by w	2.45	2.36	2.27	2.18	2. 8	1.59	1.49	1.39	1.28	1.19	1.19
w s w	3.39	3.28	3.17	3. 5	2.53	2.41	2.29	2.16	2. 3	1.51	1.51
w by s	4.45	4.32	4.19	4. 6	3.52	3.38	3.23	3. 8	2 52	2.38	2.27
Weſt	6. 0	5.46	5.32	5.18	5. 4	4.49	4.33	4.17	4. 0	3.45	3.33
w by n					6.22	6. 8	5.53	5.38	5.22	5. 8	4.57
w n w									6.44	6.33	6.24
☉ ſet	6. 0	6. 7	6.15	6.22	6.29	6.37	6 45	6.53	7. 1	7. 8	7.14
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	3. 6	5.45	9.17	12.24	15.31	18.40	21.49	25.0	26.35	29.32

4m) SOUTH DECLINATION. (4½ m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.27	0.28	0.30	0.31	0.33	0.35	0.36	0.38	0.40	0.41	0.43
s s w	0.55	0.58	1. 1	1. 5	1. 8	1.11	1.15	1.18	1.22	1.25	1.27
sw by s	1.26	1.31	1.36	1.41	1.46	1.51	1.57	2. 2	2. 8	2.13	2.16
s w	2. 2	2. 9	2.16	2.22	2.30	2.37	2.45	2.53	3. 1	3. 7	3.12
sw by w	2.45	2.54	3. 4	3.13	3.22	3.32	3.42	3.52	4. 3	4.12	4.18
w s w	3.39	3.51	4. 2	4.13	4.25	4.37	4.49	5. 2			
w by s.	4.45	4.58	5.11	5.25							
Weſt	6. 0										
☉ ſet	6. 0	5.53	5.45	5.38	5 31	5.23	5.15	5. 7	4.59	4.52	4.46

A Sun-Dial for the Latitude of 37 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.27	0.26	0.24	0.23	0.21	0.19	0.18	0.16	0.14	0.13	0.12
s s w	0.56	0.53	0.50	0.46	0.43	0.40	0.36	0.33	0.29	0.26	0.24
sw by s	1.28	1.23	1.18	1.13	1. 8	1. 2	0.57	0.52	0.47	0.41	0.38
s w	2. 4	1.57	1.50	1.43	1.36	1.29	1.22	1.14	1. 7	1. 0	0.55
sw by w	2.48	2.39	2.30	2.21	2.12	2. 3	1.53	1.43	1.33	1,24	1.17
w s w	3.42	3.31	3.20	3. 9	2.57	2.44	2.34	2.21	2. 8	1.57	1 48
w by s	4.47	4.34	4.21	4. 9	3.56	3.42	3.28	3.13	2.58	2.45	2,34
Weſt	6. 0	5.47	5,33	5,19	5. 6	4.52	1.37	4.21	4. 5	3.50	3.39
w by n					6.22	6. 8	5.54	5,40	5.24	5.11	5. 0
w n w									6.44	6.33	6.25
⊙ ſet	6. 0	6. 8	6.15	6.23	6.31	6.39	6.47	6.55	7. 4	7.11	7.17
Sun's Ampl.	d m 0. 0	d m 3. 8	d m 6.16	d m 9.25	d m 12.32	d m 15.44	d m 18.55	d m 22. 8	d m 25.21	d m 27.50	d m 29.58

4½ m) SOUTH DECLINATION. (5m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.27	0.29	0.31	0.32	0.34	0.35	0.37	0.39	0 41	0.42	0.43
s s w	0 56	0.59	1. 2	1. 6	1. 9	1.12	1.16	1.19	1.23	1.26	1.28
sw by s	1.28	1 33	1.37	1.42	1.47	1.53	1.58	2. 4	2. 9	2.14	2.17
s w	2. 4	2.11	2.18	2.25	2.32	2.30	2.46	2.54	3. 2	3. 8	3.13
sw by w	2.48	2.57	3. 6	3.15	3.24	3.33	3.43	3.53	4. 3	4.12	4.19
w s w	3.42	3.53	4. 4	4.15	4.26	4.38	4.50	5. 2			
w by s	4 47	5. 0	5.12	5 25							
Weſt	6. 0										
⊙ ſet	6. 0	5.52	5.45	5.37	5.29	5.21	5.13	5. 5	4.56	4.49	4.43

A Sun-Dial for the Latitude of 37 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.28	0.26	0.25	0.23	0.21	0.20	0.18	0.17	0.15	0.13	0.12
s s w	0.57	0.54	0.51	0.48	0.45	0.41	0.38	0.34	0.31	0.28	0.26
sw by s	1.29	1.24	1.20	1.15	1.10	1. 5	1 .0	0.54	0.49	0.44	0.41
s w	2. 6	2. 0	1.53	1.46	1.39	1.32	1.25	1.18	1.10	1. 4	0.59
sw by w	2.51	2.42	2.33	2.24	2.15	2. 6	1.57	1.47	1.37	1,29	1.22
w s w	3.44	3.34	3.23	3.12	3. 1	2.50	2.39	2.26	2.13	2. 3	1 54
w by s	4.48	4.36	4.24	4.12	4. 0	3.46	3.33	3.18	3. 3	2.50	2,40
Weſt	6. 0	5.47	5,34	5,21	5. 8	4.54	4.41	4.25	4. 9	3.55	3.45
w by n					6.22	6. 9	5.56	5,41	5.26	5.14	5. 4
w n w									6.45	6.34	6.26
⊙ ſet	6. 0	6. 8	6.16	6.24	6.32	6.40	6.48	6.57	7. 6	7.14	7.19
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	3.10	6.21	9.31	12.43	15.56	19.11	22.26	25.43	28.23	30.24

4½ m) SOUTH DECLINATION. (5m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.28	0.30	0.31	0.33	0.34	0.36	0.38	0.39	0 41	0.42	0.44
s s w	0 57	1. 0	1. 4	1. 7	1.10	1.13	1.16	1.29	1.24	1.27	1.29
sw by s	1.29	1.34	1.39	1.44	1.49	1.54	1.59	2. 5	2.11	2.15	2.18
s w	2. 6	2.13	2.20	2.27	2.34	2.41	2.48	2.55	3. 1	3. 9	3.14
sw by w	2.51	2.59	3. 8	3.17	3.26	3.35	3.44	3.54	4. 4	4.12	4.19
w s w	3.44	3.35	4. 6	4.17	4.28	4.39	4.50	5. 2			
w by s	4 48	5. 0	5.13	5 25							
Weſt	6. 0										
⊙ ſet	6. 0	5.52	5.44	5.36	5.28	5.20	5.12	5. 3	4.54	4.46	4.41

A Sun-Dial for the Latitude of 39 Degrees.

NORTH DECLINATION.

eg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.29	0.27	0.25	0.24	0.22	0.21	0.19	0.17	0.16	0.14	0.13
s s w	0.58	0.55	0.50	0.49	0.46	0.43	0.39	0.36	0.32	0.30	0.27
sw by s	1.31	1.26	1.22	1.17	1.12	1. 7	1. 2	0.57	0.51	0.47	0.43
s w	2. 9	2. 2	1.55	1.49	1.42	1.35	1.28	1.21	1.13	1. 7	1. 2
sw by w	2.53	2.45	2.36	2.27	2.19	2.10	2. 1	1.51	1.41	1.33	1.27
w s w	3.47	3.36	3.26	3.15	3. 5	2.54	2.42	2.31	2.18	2. 8	2. 0
w by s	4.50	4.38	4.26	4.14	4. 2	3.49	3.36	3.23	3. 8	2.56	2.47
Weſt	6. 0	5.48	5.35	5.22	5.10	4.56	4.43	4.28	4.13	4. 0	3.50
w by n					6.22	6.10	5.37	5.44	5.29	5.16	5. 7
w n w									6.45	6.35	6.27
⊙ ſet	6. 0	6. 8	6.16	6.24	6.32	6.41	6.50	6.59	7. 9	7.16	7.22
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	3.13	6.26	9.40	12.54	16.10	19.28	22.45	26.6	28.49	30.52

4½ m) **SOUTH DECLINATION.** (5m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.29	0.30	0.32	0.33	0.35	0.36	0.38	0.40	0.41	0.43	0.44
s s w	1.58	1. 2	1. 5	1. 8	1.11	1.14	1.18	1.21	1.25	1.27	1.30
sw by s	1.31	1.36	1.41	1.46	1.51	1.56	2. 1	2. 6	2.11	2.16	2.19
s w	2. 9	2.15	2.22	2.29	2.35	2.42	2.49	2.57	3. 4	3.10	3.15
sw by w	2.53	3. 2	3.10	3.19	3.27	3.36	3.46	3.55	4. 5	4.13	4.20
w s w	3.47	3.57	4. 8	4.18	4.29	4.39	4.51	5. 3			
w by s	4.50	5. 2	5.14	5.26							
Weſt	6. 0										
⊙ ſet	6. 0	5.52	5.44	5.36	5.28	5.19	5.10	5. 1	4.51	4.44	4.38

A Sun-Dial for the Latitude of 40 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.29	0.28	0.26	0.24	0.23	0.21	0.20	0.18	0.17	0.15	0.14
s s w	1. 0	0.57	0.53	0.50	0.47	0.44	0.41	0.37	0.34	0.31	0.29
sw by s	1.33	1.28	1.24	1.19	1.14	1. 9	1. 4	0.59	0.54	0.49	0.46
s w	2.11	2. 4	1.58	1.51	1.45	1.38	1.31	1.24	1.17	1.11	1. 6
sw by w	2.56	2.47	2.39	2.30	2.22	2.14	2. 4	1.55	1.46	1.38	1.31
w s w	3.49	3.39	3.29	3.18	3. 8	2.58	2.46	2.35	2.23	2.13	2. 5
w by s	4.51	4.40	4.28	4.17	4. 5	3.53	3.40	3.27	3.13	3. 2	2.52
Weſt	6. 0	5.48	5.30	5.23	5.11	4.59	4.46	4.32	4.17	4. 5	3.55
w by n					6.22	6.43	5.58	5.45	5.31	5.19	5.10
w n w								6.58	6.46	6.36	6.28
⊙ ſet	6. 0	6. 8	6.17	6.25	6.34	6.43	6.52	7. 1	7.11	7.19	7.25
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	3.15	6.32	9.48	13.6	16.24	19.45	23.6	26.30	29.16	31.32

4½ m) SOUTH DECLINATION. (5m

eg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.29	0.31	0.32	0.34	0.35	0.37	0.38	0.40	0.42	0.43	0.44
s s w	1. 0	1. 3	1. 6	1. 9	1.12	1.15	1.18	1.22	1.25	1.28	1.30
sw by s	1.13	1.38	1.43	1.47	1.52	1.57	2. 2	2. 7	2.12	2.17	2.20
s w	2.11	2.17	2.24	2.31	2.37	2.44	2.51	2.58	3. 5	3.11	3.16
sw by w	2.56	3. 4	3.12	3.21	3.29	3.38	3.47	3.56	4. 6	4.14	4.20
w s w	3.49	3.59	4. 9	4.19	4.30	4.40	4.51	5. 3			
w by s	4.51	5. 3	5.14	5.26							
Weſt	6. 0										
⊙ ſet	6. 0	5.52	5.43	5.35	5.26	5.17	5. 8	4.59	4.49	4.41	4.35

A Sun-Dial for the Latitude of 41 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.30	0.28	0.27	0.25	0.24	0.22	0.21	0.19	0.17	0.16	0.15
s s w	1. 1	0.58	0.55	0.52	0.49	0.46	0.42	0.39	0.36	0.33	0.31
sw by s	1.35	1.30	1.25	1.21	1.16	1.11	1. 6	1. 1	0.56	0.52	0.48
s w	2.13	2. 7	2. 0	1.54	1.48	1.41	1.34	1.27	1.20	1.14	1. 9
sw by w	2.58	2.50	2.42	2.33	2.25	2.17	2. 8	1.59	1.50	1.42	1.36
w s w	3.51	3.41	3.31	3.21	3.11	3. 1	2 50	2.39	2.28	2.18	2.11
w by s	4.53	4.42	4.30	4.19	4. 8	3.57	3.44	3.31	3.18	3. 7	2.58
West	6. 0	5.48	5.36	5.25	5.13	5. 1	4.48	4.35	4.21	4. 9	4. 0
w by n					6.23	6.12	5.59	5.46	5.33	5.22	5.13
w n w								6,58	6.46	6.37	6.2,
⊙ ſet	6. 0	6. 9	6 17	6.26	6.35	6.44	6.54	7. 4	7.14	7.22	7.29
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0. 0	3.18	6.38	9.57	13.18	16.40	20.4	23.29	26, 56	29.45	31.54

4½m) SOUTH DECLINATION. 5m)

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.30	0.31	0.33	0.34	0.36	0.37	0.39	0.40	0.42	0.44	0.45
s s w	1. 1	1. 4	1. 7	1.10	1.13	1.16	1.19	1.23	1.26	1.29	1.31
sw by s	1.35	1.39	1.44	1.49	1.53	1.58	2. 3	2. 8	2.13	2.18	2.21
s w	2.13	2.19	2.26	2.32	2.39	2.45	2.52	2.59	3. 6	3.12	3.17
sw by w	2.58	3. 6	3.14	3.22	3.31	3.39	3.48	3.57	4. 6	4.14	4.20
w s w	3.51	4. 1	4.11	4.21	4.30	4.40	4.51	5. 3			
w by s	4.53	5. 4	5.15	5.26							
West	6. 0										
⊙ ſet	6. 0	5.51	5.43	5.34	5.25	5.16	5. 6	4.56	4.46	4.38	4.31

A Sun-Dial for the Latitude of 42 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.30	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.18	0.17	0.16
s s w	1. 2	0.59	0.56	0.53	0.50	0 47	0.44	0.41	0.37	0.34	0.32
sw by s	1.36	1.32	1.27	1.23	1.18	1.13	1. 9	1. 4	0.58	0.54	0.51
s w	2.15	2. 9	2. 3	1.56	1.50	1.44	1.37	1.30	1.23	1.17	1.13
sw by w	3. 0	2.52	2.44	2.36	2.28	2.20	2.12	2. 3	1.54	1.46	1.40
w s w	3.53	3.43	3.34	3.24	3.15	3. 5	2 54	2.44	2.33	2.23	2.16
w by s	4.54	4.43	4.32	4.21	4.10	4. 0	3.48	3.36	3.23	3.12	3. 3
West	6. 0	5.49	5.37	5.26	5.15	5. 3	4.51	4.39	4.24	4.13	4 4
w by n					6.23	6.12	6. 0	5.48	5.35	5.24	5 16
w n w								6,58	6.47	6.37	5.30
⊙ ſet	6. 0	6. 9	6 18	6.27	6.37	6.46	6.56	7. 6	7.17	7,25	7.32
Sun's Ampl.	d m 0. 0	d m 3.21	d m 6.44	d m 10.6	d m 13.31	d m 16.56	d m 20.23	d m 23 52	d m 27.24	d m 30.16	d m 32.28

4½m) SOUTH DECLINATION. 5m)

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.30	0.32	0.33	0.35	0.36	0.38	0.39	0.41	0.43	0.44	0.45
s s w	1. 2	1. 5	1. 8	1.11	1.14	1.17	1.20	1.23	1.27	1.30	1.32
sw by s	1.36	1.41	1.46	1.50	1.55	1 59	2. 4	2. 9	2.14	2.19	2.22
s w	2.15	2.21	2.28	2.34	2.40	2.46	2.53	3. 0	3. 7	3.13	3.17
sw by w	3. 0	3. 8	3.16	3.24	3.32	3.40	3.49	3.57	4. 7	4.14	4.20
w s w	3.53	4. 2	4.12	4.22	4.31	4.41	4.52				
w by s	4.54	5. 4	5.15	5.26							
West	6. 0										
⊙ ſet	6. 0	5.51	5.42	5.33	5.23	5.14	5. 4	5.54	4.43	4.35	4.28

A Sun-Dial for the Latitude of 43 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.29	0.28	0.27	0.25	0.24	0.22	0.21	0.19	0.18	0.17
s s w	1. 3	1. 0	0.57	0.54	0.51	0.48	0.45	0.42	0.39	0.36	0.34
sw by s	1.38	1.34	1.29	1.25	1.20	1.15	1.11	1. 6	1. 1	0.57	0.53
s w	2.17	2.11	2. 5	1.59	1.53	1.47	1.40	1.33	1.26	1.20	1.16
sw by w	3. 2	2.55	2.4	2.39	2.3	2.23	2.15	2. 7	1.58	1.50	1.44
w s w	3.55	3.46	3.36	3.2	3 18	3. 8	2.58	2.48	2.37	2.28	2.21
w by s	4.55	4.45	4.34	4.23	4.13	4. 3	3.52	3.40	3.27	3.17	3, 9
Weſt	6. 0	5.49	5.38	5.27	5 16	5. 5	4.53	4.41	4.2	4.17	4. 9
w by n					6.23	6.13	6. 1	5.50	5.37	5.27	5.19
w n w								6.58	6.47	6.38	6.31
⊙ ſet	6. 0	6. 9	6.19	6.28	6.38	6.48	6.58	7. 9	7.19	7.28	7.36
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	3.25	6.51	10.17	13.44	17.13	20.43	24.16	27.53	30.48	33.3

5 m) SOUTH DECLINATION. (6m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.32	0.34	0.35	0.37	0.38	0.40	0.41	0.43	0.44	0.45
s s w	1. 3	1. 6	1. 9	1.12	1.15	1.18	1.21	1.24	1.27	1.30	1.32
sw by s	1.38	1.42	1.47	1.52	1.56	2. 1	2. 5	2.10	2.15	2.19	2.23
s w	2.17	2.23	2.29	2.36	2.42	2.48	2.54	3. 1	3. 8	3.14	3.18
sw by w	3. 2	3.10	3.18	3.26	3.33	3.41	3.51	3.58	4. 7	4.14	4.20
w s w	3.55	4. 4	4.14	4.23	4.32	4.4	4.52				
w by s	4.55	5. 5	5.16	5.26							
Weſt	6. 0										
⊙ ſet	6. 0	5.51	5.41	5.32	5.22	5.12	5. 2	4.51	4.41	4.32	4.24

A Sun-Dial for the Latitude of 44 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.30	0.29	0.27	0.26	0.24	0.23	0.21	0.20	0.18	0.17
s s w	1. 4	1. 1	0.58	0.56	0.53	0.50	0.47	0.44	0.40	0.38	0.36
sw by s	1.40	1.35	1.31	1.27	1.22	1.18	1.13	1. 8	1. 3	0.59	0.56
s w	2.19	2.13	2. 7	2. 1	1.55	1.49	1.43	1.36	1.29	1.24	1.20
sw by w	3. 4	2.57	2.49	2.42	2.34	2.26	2.18	2.10	2. 1	1.54	1.49
w s w	3.57	3.48	3.38	3.29	3 21	3.12	3. 2	2.52	2.41	2.33	2.26
w by s	4.56	4.46	4.36	4.26	4.16	4. 5	3.54	3.43	3.31	3.21	3,13
Weſt	6. 0	5.50	5.39	5.28	5.18	5. 7	4.56	4.44	4.31	4.21	4.13
w by n					6.23	6.13	6. 2	5.51	5.39	5.29	5.21
w n w								6.59	6.48	6.39	6.32
⊙ ſet	6. 0	6.10	6.19	6.29	6.39	6.49	7. 0	7.11	7.22	7.31	7.39
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	3.28	6.58	10.27	13.58	17.30	21.5	24.42	28.23	31.22	33.40

5 m) SOUTH DECLINATION. (6m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.31	0.33	0.34	0.36	0.37	0.39	0.40	0.42	0.43	0.45	0.46
s s w	1. 4	1. 7	1,10	1.13	1.16	1.19	1.22	1.25	1.28	1.31	1.33
sw by s	1 40	1.44	1.48	1.53	1.57	2. 2	2. 6	2.11	2.16	2.20	2.23
s w	2.19	2.25	2.31	2.37	2.43	2.49	2.56	3. 2	3. 9	3.14	3.19
sw by w	3. 4	3.12	3.19	3.27	3.35	3.42	3.51	3.59	4. 8	4.15	4.20
w s w	3.57	4. 6	4.15	4.24	4.3[illegible]	4.4[illegible]	4.52				
w by s	4.56	5. 6	5.16	5.26							
Weſt	6. 0										
⊙ ſet	6. 0	5.50	5.41	5.31	5.21	5.11	5. 0	4.49	4.38	4.29	4.21

A Sun-Dial for the Latitude of 45 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.32	0.31	0.29	0.28	0.26	0.25	0.24	0.22	0 20	0.19	0.18
s s w	1. 5	1. 3	1. 0	0.57	0.54	0.51	0.48	0 45	0.42	0.39	0.37
sw by s	1.41	1.37	1.33	1.26	1.24	1.19	1.15	1.10	1. 5	1. 1	0.58
s w	2.21	2.15	2. 9	2. 3	1.58	1.52	1.45	1.39	1.33	1.27	1.23
sw by w	3. 6	2.59	2.52	2.45	2.37	2.29	2.22	2.13	2. 5	1.58	1.53
w s w	3.59	3.50	3.41	3.32	3.23	3.14	3. 5	2.55	2.45	2.37	2.30
w by s	4.57	4.47	4.38	4.28	4 18	4. 8	3.57	3.46	3.35	3.26	3.18
Weſt	6. 0	5.50	5.40	5.30	5.19	5. 9	4.58	4.46	4.35	4.25	4 17
w by n					6.24	6.14	6. 3	5.52	5.41	5.31	5.24
w n w								6.59	6.48	6.40	6,33
nw by w											7.40
⊙ ſet	6. 0	6.10	6.20	6.30	6.41	6.51	7. 2	7.13	7.25	7.35	7.43
Sun's Ampl	d m 0. 0	d m 3.82	d m 7. 5	d m 10.38	d m 14.13	d m 17.49	d m 21.28	d m 25.9	d m 28.56	d m 31.58	d m 34.20

5m) SOUTH DECLINATION. (6m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.32	0.33	0.35	0.36	0.38	0.39	0 41	0.42	0.44	0.45	0 46
s s w	1. 5	1. 8	1.11	1.14	1.17	1.20	1.23	1.26	1.29	1.31	1.33
sw by s	1.41	1.45	1.50	1.54	1.58	2. 3	2. 7	2.12	2.17	2.21	2.24
s w	2.21	2.27	2.33	2.39	2.44	2.51	2.57	3. 3	3.10	3.15	3.19
sw by w	3. 6	3.14	3.21	3.28	3.36	3.44	3.51	4. 0	4. 8	4.15	
w s w	3.59	4. 7	4.16	4.25	4.34	4.43	4.52				
w by s	4.57	5. 7	5.17	5.26							
Weſt	6. 0										
⊙ ſet	6. 0	5.50	5.40	5.30	5.19	5. 9	4.58	4.47	4.35	4.25	4.17

A Sun-Dial for the Latitude of 46 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.31	0.30	0.29	0.27	0.26	0.24	0.23	0 21	0.20	0.19
s s w	1. 6	1. 4	1. 1	0.58	0.55	0.52	0.49	0 46	0.43	0.41	0.39
sw by s	1.43	1.38	1.34	1.30	1.26	1.21	1.17	1.12	1. 8	1. 4	1. 1
s w	2.23	2.17	2.11	2. 6	2. 0	1.54	1.48	1.42	1.36	1.30	1.26
sw by w	3. 8	3. 1	2.54	2.47	2.40	2.32	2.25	2.17	2. 9	2. 2	1.57
w s w	4. 0	3.52	3.43	3.35	3.26	3.17	3. 8	2.59	2.49	2.41	2.35
w by s	5.58	4.49	4.39	4.39	4 20	4.11	4. 0	3.50	3.39	3.30	3.23
Weſt	6. 0	5.50	5.40	5.30	5.26	5.11	5. 0	4.49	4.38	4.2[illegible]	4.21
w by n					6.24	6.14	6. 4	5.54	5.43	5.33	5.26
w n w								6.59	6.49	6.41	6.34
nw by w											7.41
⊙ ſet	6. 0	6.10	6.21	6.31	6.42	6.53	7. 4	7.16	7.29	7.39	7.47
Sun's.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl	0 .0	3.36	7.12	10.50	14.28	18.9	21.52	25.39	29.31	32.37	35.3

5m) SOUTH DECLINATION. (6m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.34	0.35	0.37	0.38	0.40	0 41	0.42	0.44	0.45	0 46
s s w	1. 6	1. 9	1.12	1.15	1.18	1.20	1.2	1.26	1.29	1.32	1.34
sw by s	1.43	1.47	1.51	1.55	2. 0	2. 4	2. 8	2.13	2.18	2.22	2.25
s w	2.23	2.29	2.34	2.40	2.46	2.52	2.58	3. 4	3.10	3.16	3.20
sw by w	3. 8	3.16	3.23	3.30	3.37	3.45	3.52	4. 0	4. 8	4.15	
w s w	4. 0	4. 9	4.17	4.26	4.34	4.43					
w by s	4.58	5. 8	5.17	5.26							
Weſt	6. 0										
⊙ ſet	6. 0	5.50	5.39	5.29	5.18	5. 7	4.56	4.44	4.31	4.21	4.13

A Sun-Dial for the Latitude of 47 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.32	0.30	0.29	0.28	0.26	0.25	0.23	0.22	0.21	0.20
s s w	1. 7	1. 5	1. 2	0.51	0.56	0.54	0.51	0.48	0.45	0.42	0.40
sw by s	1.44	1.40	1.36	1.32	1.28	1.23	1.19	1.15	1.10	1. 6	1. 3
s w	2.25	2.19	2.14	2. 8	2. 2	1.57	1.51	1.45	1.39	1.33	1.29
sw by w	3.10	3. 3	2.56	2.49	2.43	2.35	2.38	2.20	2.13	2. 6	2. 1
w s w	4. 2	3.54	3.46	3.37	3.29	3.20	3.12	3. 3	2.53	2.45	2.39
w by s	4.59	4.50	4.41	4.32	4.23	4.13	4. 3	3.53	3.43	3.34	3.27
Weſt	6. 0	5.51	5 41	5.32	5.22	5.12	5. 2	4.52	4.41	4.31	4.24
w by n				6.34	6.25	6.15	6. 5	5.55	5.44	5.36	5.29
w n w							7. 8	6.59	6.49	6.41	6.35
nw byw											7.40
⊙ ſet	6. 0	6.11	6.22	6.33	6.43	6.55	7. 7	7.20	7.32	7.43	7.51
Sun's Ampl.	d m 0 .0	d m 3.40	d m 7.20	d m 11.2	d m 14.44	d m 18.30	d m 22.18	d m 26.10	d m 30.7	d m 33.18	d m 35.48

5 m) **SOUTH DECLINATION.** (6m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.33	0.33	0.36	0.37	0.38	0.40	0.41	0.43	0.44	0.45	0.46
s s w	1. 7	1.10	1.13	1.16	1.18	1.21	1.24	1.27	1.30	1.32	1.34
s w by s	1.44	1.48	1.52	1.57	2. 1	2. 5	2. 9	2.14	2.18	2.22	2.25
s w	2.25	2.30	2.36	2.41	2.47	2.53	2.59	3. 5	3.11	3.16	3.20
sw by w	3.10	3.17	3.24	3.31	3.38	3.45	3.53	4. 0	4. 8		
w s w	4. 2	4.10	4.18	4.26	4.35	4.43					
w by s	4.59	5. 8	5.17								
Weſt	6. 0										
⊙ ſet	6. 0	5.49	5.38	5.27	5.17	5. 5	4.53	4.40	4.28	4.17	4. 9

A Sun-Dial for the Latitude of 48 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.34	0.32	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22	0.21
s s w	1. 8	1. 6	1. 3	1. 0	0.58	0.55	0.52	0.49	0.46	0.44	0.42
sw by s	1.46	1.42	1.38	1.34	1.30	1.25	1.21	1.17	1.12	1. 8	1. 5
s w	2.27	2 21	2.16	2.10	2. 5	1.59	1.53	1.47	1.41	1.36	1.32
sw by w	3.12	3. 6	2.59	2.52	2.46	2.38	2.31	2.23	2.16	2. 9	2. 4
w s w	4. 3	3.56	3.48	3.40	3.32	3.23	3.15	3. 6	2.57	2.49	2.43
w by s	5. 0	4.51	4.43	4.34	4.25	4.16	4. 6	3.56	3.46	3.38	3.31
Weſt	6. 0	5.51	5 42	5.33	5.23	5.14	5. 4	4.54	4.43	4.35	4.28
w by n				6.34	6.25	6.10	6. 6	5.56	5.46	5.38	5.31
w n w							7. 8	6.59	6.50	6.42	6.36
nw byw										7.45	7.40
⊙ ſet	6. 0	6.11	6.22	6.33	6.45	6.57	7. 9	7.22	7.35	7.47	7.56
Sun's Ampl.	d m 0 .0	d m 3.44	d m 7.29	d m 11.15	d m 15.2	d m 18.52	d m 22.45	d m 26.43	d m 30.45	d m 34.3	d m 36.35

5m) SOUTH DECLINATION. (6m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.34	0.35	0.36	0.38	0.39	0.40	0.42	0.43	0.45	0.46	0.47
s s w	1. 8	1.11	1.14	1.16	1.19	1.22	1.25	1.28	1.31	1.33	1.35
s w by s	1.46	1.50	1.54	1.58	2. 2	2. 6	2.10	2.15	2.19	2.23	2.26
s w	2.27	2.32	2.37	2.43	2.48	2.54	3. 0	3. 5	3.12	3.17	3.21
sw by w	3.12	3.19	3.26	3.32	3.39	3.45	3.53	4. 1	4. 9		
w s w	4. 3	4.11	4.19	4.27	4.35	4.44					
w by s	5. 0	5. 9	5.17	5.26							
Weſt	6. 0										
⊙ ſet	6. 0	5.49	5.38	5.27	5.15	5. 3	4.51	4.38	4.25	4.13	4. 4

A Sun-Dial for the Latitude of 49 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.34	0.33	0.32	0.30	0.29	0.28	0.26	0.25	0.23	0.22	0.21
s s w	1. 9	1. 7	1. 4	1. 2	0.59	0.56	0.53	0.51	0.48	0.45	0.44
sw by s	1.47	1.43	1.39	1.35	1.31	1.27	1.23	1.19	1.14	1.11	1. 8
s w	2.28	2 23	2.18	2.12	2. 7	2. 1	1.56	1.50	1.44	1.39	1.35
sw by w	3.14	3. 7	3. 1	2.54	2.48	2.41	2.34	2.27	2.19	2.13	2. 8
w s w	4. 5	3.57	3.50	3.42	3.34	3.26	3.18	3. 9	3. 0	2.53	2.47
w by s	5. 1	4.53	4.44	4.36	4.27	4.18	4. 9	4. 0	3.50	3.42	3.35
Weſt	6. 0	5.51	5 42	5.34	5.25	5.16	5. 6	4.56	4.46	4.38	4.31
w by n				6.34	6:25	6.16	6. 7	5.58	5.48	5.40	5.33
w n w							7. 8	7. 0	6.51	6.43	6.38
nw by w										7.45	7.41
☉ ſet	6. 0	6.11	6.23	6.34	6.47	6.59	7.12	7.25	7.39	7.51	8. 0
Sun's Ampl.	d m 0 .0	d m 3.48	d m 7.38	d m 11.28	d m 15.21	d m 19.15	d m 23.14	d m 27.17	d m 31.25	d m 34.48	d m 37.26

5m) SOUTH DECLINATION. (6m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.34	0.35	0.37	0.38	0.39	0.41	0.42	0.43	0 45	0.46	0.47
s s w	1. 9	1.11	1.15	1.17	1.20	1.23	1.25	1.28	1.31	1.33	1.35
s w by s	1.47	1.51	1.55	1.59	2. 3	2. 7	2.11	2.15	2.20	2.23	2.26
s w	2.28	2.33	2.39	2.44	2.49	2.55	3. 0	3. 6	3.12	3.17	3.21
sw by w	3.14	3.20	3.27	3.34	3.40	3.47	3.54	4. 1	4. 9		
w s w	4. 5	4.13	4.20	4.28	4.36	4.44					
w by s	5. 1	5. 9	5.18								
Weſt	6. 0										
☉ ſet	6. 0	5.49	5.37	5.26	5.13	5. 1	4.48	4.35	4.21	4. 9	4. 0

A Sun-Dial for the Latitude of 50 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.33	0.32	0.31	0.30	0.28	0.27	0.26	0.24	0.23	0.22
s s w	1.10	1. 8	1. 5	1. 3	0. 0	1.58	0.55	0.52	0.49	0.47	0.45
sw by s	1.48	1.45	1.41	1.37	1.33	1.29	1.25	1.21	1.16	1.13	1.10
s w	2.30	2.25	2.20	2.15	2. 9	2. 4	1.58	1.53	1.47	1.42	1.38
sw by w	3.16	3. 9	3. 3	2.56	2.50	2.43	2.36	2.30	2.23	2.16	2.12
w s w	4. 6	3.59	3.51	3.44	3.36	3.29	3.21	3.13	3. 4	2.57	2.51
w by s	5. 2	4.54	4.45	4.37	4.29	4.20	4.12	4. 3	3.53	3.45	3.39
Weſt	6. 0	5.52	5.43	5.34	5.26	5.17	5. 8	4.59	4.49	4.41	4 34
w by n				6.34	6.25	6.17	6. 8	5.59	5.49	5.42	5.36
w n w							7. 8	7. 0	6.51	6.44	6.39
nw by w										7.45	7.41
⊙ ſet	6. 0	6.12	6.24	6.36	6.49	7. 1	7.14	7.28	7.43	7.55	8. 5
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	3.53	7.48	11.42	15.40	19.40	23.45	27.53	32.8	35.37	38.20

5½m) SOUTH DECLINATION. (6½m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23d 29m.
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.36	0.37	0.38	0.40	0.41	0.42	0 44	0.45	0.46	0.47
s s w	1.10	1.13	1.15	1.18	1.21	1.23	1.26	1.29	1.32	1.34	1.36
sw by s	1.48	1.52	1.56	2. 0	2. 4	2. 8	2.12	2.16	2.20	2.24	2.27
s w	2.30	2.35	2.40	2.45	2.50	2.56	3. 1	3. 7	3.13	3.17	3.21
sw by w	3.16	3.22	3.28	3.35	3.41	3.48	3.55	4. 2	4. 9		
w s w	4. 6	4.14	4.21	4.29	4.36	4.44					
w by s	5. 2	5.10	5.18								
Weſt	6. 0										
⊙ ſet	6. 0	5.48	5.36	5.24	5.11	4.59	4.46	4.32	4.17	4. 5	3. 5

A Sun-Dial for the Latitude of 51 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.34	0.33	0.31	0.30	0.29	0.28	0.26	0.25	0.24	0.23
s s w	1.11	1. 9	1. 6	1. 4	1. 1	0.59	0.56	0.53	0.51	0.48	0.47
sw by s	1.50	1.46	1.42	1.39	1.35	1.31	1.27	1.23	1.19	1.15	1.12
s w	2.31	2.26	2.21	2.16	2.11	2. 6	2. 1	1.55	1.50	1.45	1.41
sw by w	3.17	3.11	3. 5	2.59	2.52	2.46	2.39	2.33	2.26	2.20	2.15
w s w	4. 8	4. 1	3.53	3.46	3.39	3.31	3.24	3.16	3. 8	3. 1	2.55
w by s	5. 3	4.55	4.47	4.39	4.31	4.22	4.14	4. 5	3.56	4.49	3.43
West	6. 0	5.52	5.44	5.35	5.27	5.18	5.10	5. 1	4.52	4.44	4.37
w by n				6.34	6.26	6.17	6. 9	6. 0	5.51	5.44	5.38
w n w							7. 8	7. 0	6.52	6.45	6.40
nw by w										7.45	7.42
☉ ſet	6. 0	6.12	6.25	6.38	6.50	7. 3	7.17	7.32	7.47	8. 0	8.10
Sun's Ampl.	d m 0. 0	d m 3.58	d m 7.58	d m 11.57	d m 16.1	d m 20.8	d m 24.18	d m 28.33	d m 32.54	d m 36.30	d m 39.19

5½ m) **SOUTH DECLINATION.** (6½m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.35	0.36	0.38	0.39	0.40	0.41	0.42	0.44	0.46	0.47	0.48
s s w	1.11	1.14	1.16	1.19	1.21	1.24	1.27	1.29	1.32	1.34	1.36
sw by s	1.50	1.53	1.57	2. 1	2. 5	2. 9	2.13	2.17	2.21	2.24	2.27
s w	2.31	2.36	2.41	2.46	2.52	2.57	3. 2	3. 7	3.13	3.18	3.21
sw by w	3.17	3.23	3.30	3.36	3.42	3.49	3.55	4. 2	4. 9		
w s w	4. 8	4.15	4.22	4.29	4.37	4.44					
w by s	5. 3	5.10	5.18								
West	6. 0										
☉ ſet	6. 0	5.48	5.35	5.22	5.10	4.57	4.53	4.28	4.13	4. 0	3.5

A Sun-Dial for the Latitude of 52 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.36	0.34	0.33	0.32	0.31	0.30	0.28	0.27	0.26	0.25	0.24
s s w	1.12	1.10	1. 8	1. 5	1. 3	1. 0	0.57	0.55	0.52	0.50	0.48
sw by s	1.51	1.47	1.44	1.40	1.36	1.33	1.29	1.25	1.21	1.17	1.15
s w	2.33	2.28	2.23	2.18	2.13	2. 8	2. 3	1.58	1.52	1.48	1.44
sw by w	3.19	3.13	3. 7	3. 1	2.55	2.48	2.42	2.36	2.29	2.24	2.19
w s w	4. 9	4. 2	3.55	3.48	3.41	3.34	3.26	3.19	3.11	3. 4	2.59
w by s	5. 3	4.56	4.48	4.40	4.33	4.25	4.16	4. 8	3.59	3.52	3.46
West	6. 0	5.52	5.44	5.36	5.28	5.20	5.12	5. 3	4.54	4.46	4.40
w by n				6.34	6.26	6.18	6.10	6. 1	5.53	5.45	5.40
w n w							7. 8	7. 0	6.53	6.46	6.41
nw by w										7.45	7.41
⊙ ſet	6. 0	6.13	6.26	6.39	6.52	7. [illegible]	7.20	7.35	7.51	8. 5	8.16
Sun's.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl	0. 0	4. 3	8. 8	12.13	16.23	20.35	21.54	29.14	33.44	37.27	40.23

5½m) SOUTH DECLINATION. (6½m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.36	0.37	0.38	0.39	0.41	0.42	0.43	0.44	0.46	0.47	0.48
s s w	1.12	1.15	1.17	1.20	1.22	1.25	1.27	1.30	1.33	1.35	1.37
sw by s	1.51	1.55	1.58	2. 2	2. 6	2.10	2.13	2.17	2.22	2.25	2.28
s w	2.33	2.38	2.43	2.48	2.53	2.58	3. 3	3. 8	3.13	3.18	3.22
sw by w	3.19	3.25	3.31	3.37	3.43	3.49	3.56	4. 2	4.10		
w s w	4. 9	4.16	4.23	4.30	4.37	4.44					
w by s	5. 3	5.11	5.19								
West	6. 0										
⊙ ſet	6. 0	5.47	5.34	5.21	5. 8	4.54	4.40	4.25	4. 9	3.55	3.44

A Sun-Dial for the Latitude of 53 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.36	0.35	0.34	0.33	0.31	0.30	0.29	0.28	0.26	0.25	0.24
s s w	1.13	1.11	1. 8	1. 6	1. 4	1. 1	0.59	0.56	0.53	0.51	0.50
sw by s	1.52	1.49	1.45	1.4	1.38	1.34	1.31	1.27	1.23	1.19	1.17
s w	2.34	2.30	2.25	2.2	2.15	2.10	2. 5	2. 0	1.55	1.51	1.47
sw by w	3.20	3.15	3. 9	3. 3	2.57	2.51	2.45	2.38	2.32	2.26	2.22
w s w	4.10	4. 4	3.57	3.50	3.43	3.36	3.29	3.22	3.14	3. 8	3. 3
w by s	5. 4	4.57	4.49	4.42	4.34	4.27	4.19	4.11	4. 2	3.55	3.50
Weſt	6. 0	5.52	5.45	5.37	5.29	5.22	5.13	5. 5	4.56	4.49	4.43
w by n				6.34	6.26	6.19	6.11	6. 3	5.54	5.47	5.42
w n w							7. 8	7. 1	6.53	6.47	6.42
nw by w									7.51	7.46	7.42
⊙ ſet	6. 0	6.14	6.27	6.41	6.54	7. 8	7.23	7.39	7.56	8.10	8.21
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0. 0	4. 9	8.19	12.31	16.46	21.5	25.28	29.59	34.39	38.29	41.29

6 m) SOUTH DECLINATION. (7m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.36	0.37	0.3	0.40	0.41	0.42	0.43	0.45	0.46	0.47	0.48
s s w	1.13	1.16	1.18	1.20	1.23	1.25	1.28	1.30	1.33	1.35	1.37
sw by s	1.52	1.56	2. 0	2. 3	2. 7	2.10	2.14	2.18	2.22	2.25	2.28
s w	2.34	2.39	2.44	2.49	2.54	2.58	3. 3	3. 9	3.14	3.18	3.22
sw by w	3.20	3.26	3.32	3.38	3.44	3.50	3.56	4.13			
w s w	4.10	4.17	4.24	4.30	4.37	4.44					
w by s	5. 4	5.11	5.19								
Weſt	6. 0										
⊙ ſet	6. 0	5.46	5.33	5.19	5. 6	4.52	4.37	4.21	4. 4	3.50	3.30

A Sun-Dial for the Latitude of 54 Degrees.

NORTH DECLINATION.

Deg. Min	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0 35	0.34	0.33	0.32	0.31	0.29	0.28	0.27	0.26	0.25
s s w	1.14	1.12	1. 9	1. 7	1. 5	1. 2	1. 0	0.57	0.55	0.53	0.51
sw by s	1.54	1 50	1.47	1.43	1.40	1.36	1.32	1.29	1.25	1.22	1.19
s w	2.36	2.31	2.27	2.22	2.17	2.12	2. 8	2. 3	1.57	1.53	1.50
sw by w	3.22	3.16	3.11	3. 5	2.59	2.53	2.47	2.41	2.35	2.29	2.25
w s w	4.12	4. 5	3.59	3.52	3.45	3.39	3.32	3.24	3.17	3.11	3. 6
w by s	5. 5	4.58	4.51	4.43	4.36	4.29	4.21	4.13	4. 5	3.58	3.53
Weſt	6. 0	5.53	5.45	5.38	5.31	5.23	5.15	5. 7	4.59	4.52	4.46
w by n				6.34	6.27	6.19	6.11	6. 4	5.56	5.49	5.44
w n w							7. 9	7. 1	6.54	6.48	6.43
n wbyw									7.51	7.46	7.42
☉ ſet	6. 0	6.15	6.28	6.42	6.56	7.11	7.27	7.43	8. 0	8.15	8.27
Sun's Ampl.	d m 0. 0	d m 4.14	d m 8.31	d m 11.49	d m 17.11	d m 21.56	d m 26.7	d m 30 46	d m 35.35	d m 29.26	d m 42.46

6m) SOUTH DECLINATION (7½ m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.38	0.39	0.40	0.41	0.42	0.44	0.45	0.46	0.47	0.48
s s w	1.14	1.16	1.19	1.21	1.24	1.26	1.28	1.31	1.33	1.35	1.37
s w by s	1.54	1 57	2. 1	2. 4	2. 8	2.11	2.15	2.19	2.23	2.26	2.28
s w	2.36	2.41	2.45	2.50	2.54	2.59	3. 4	3. 9	3.15	3.19	3.22
sw by w	3.22	3.27	3.33	3.39	3.44	3.50	3.56	4. 3			
w s w	4.12	4.18	4.24	4.31	4.38	4.45					
w by s	5. 5	5.12	5.19								
Weſt	6. 0										
☉ ſet	6. 0	[illegible]. 6	5.32	5.18	5. 4	4.49	4.33	4.17	4. 0	3.45	3.33

A Sun-Dial for the Latitude of 55 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.36	0.35	0.34	0.33	0.31	0.30	0.29	0.28	0.27	0.26
s s w	1.15	1.13	1.10	1. 8	1. 6	1. 3	1. 1	0.59	0.56	0.54	0.52
sw by s	1.55	1.51	1.48	1.45	1.41	1.38	1.34	1.32	1.27	1.23	1.21
s w	2.37	2.33	2.28	2.24	2.19	2.14	2.10	2. 5	2. 0	1.55	1.52
sw byw	3.23	3.18	3.12	3. 7	3. 1	2.56	2.50	2.44	2.38	2.33	2.29
w s w	4.13	4. 6	4. 0	3.54	3.47	3.41	3.34	3.27	3.20	3.14	3.10
w by s	5. 5	4.59	4.52	4.45	4.38	4.31	4.23	4.16	4. 8	4. 2	3.56
Weſt	6. 0	5.53	5.46	5.39	5.32	5.24	5.17	5. 9	5. 1	4.54	4.49
w by n				6.34	6.27	6.20	6.13	6. 5	5.57	5.51	5.46
w n w							7. 9	7. 2	6.55	6.49	6.44
nw byw									7.51	7.46	7.42
☉ ſet	6. 0	6.14	6.29	6.43	6.58	7.14	7.30	7.47	8. 5	8.21	8.33
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	4.21	8.44	13.9	17.37	22.10	26.49	31.37	36.36	40.47	44.0

4 m) SOUTH DECLINATION. (4½m

Deg. Min.	0 d	2 d 30m	5d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.38	0.39	0.40	0.42	0.43	0.44	0.45	0.46	0.47	0.48
s s w	1.15	1.17	1.20	1.22	1.24	1.26	1.29	1.31	1.34	1.36	1.38
sw by s	1.55	1.58	2. 1	2. 5	2. 8	2.12	2.16	2.19	2.23	2.26	2.29
s w	2.37	2.42	2.46	2.51	2.55	3. 0	3. 5	3.10	3.15	3.19	3.22
sw by w	3.23	3.29	3.34	3.40	3.45	3.51	3.57	4. 3			
w s w	4.13	4.19	4.25	4.32	4.38	4.45					
w by s	5. 5	5.12	5.19								
Weſt	6. 0										
☉ ſet	6. 0	5.46	5.31	5.17	5. 2	4.46	4.30	4.13	3.55	3.39	3.27

A Sun-Dial for the Latitude of 56 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	[illegible]	12	12	12	12	12	12	12	12	12	12
s by w	0.3[illegible]	0.36	0.3	0 34	0.33	0.32	0.31	0.30	0.28	0.27	0.26
s s w	1.16	[illegible].14	1.11	1. 9	1. 7	1. 5	1. 2	1. 0	0.57	0.55	0.53
sw by s	1.56	1.53	1.49	1.4	1.43	1.39	1.36	1.32	1.28	1.26	1.23
s w	2.39	2.34	[illegible]	2 26	2.21	2.16	2.12	2. 7	2. 2	1.59	1.55
sw by w	3.25	3.19	3.14	3. 9	3. 3	2.58	2.52	2.46	2.40	2.36	2.32
w s w	4.14	4. 8	4. 2	3 5[illegible]	3.50	3.43	3.37	3.30	3.23	3.17	3.13
w by s	5. 6	5. 0	4.53	4.46	4.40	4.33	4.26	4.18	4.11	4. 5	4. 0
Weſt	6. 0	5.53	5.46	5.39	5.32	5.26	5.18	5.11	5. 3	4.57	4.52
w by n				6.34	6.28	6.21	6.14	6. 6	3.59	5.53	5.48
w n w						7.15	7. 9	7. 2	6 55	6.50	6.45
									7.51	7.46	7.43
⊙ ſet	6. 0	6.15	6.30	6.45	7. 0	7.16	7.14	7.52	8.11	8.27	8.41
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	4.28	8.57	13.29	18.5	22.46	27.34	32.32	37.42	42.4	45.27

6m) SOUTH DECLINATION. (8½m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.37	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.47	0.48	0.48
s s w	1. 6	1.18	1.20	1.22	1.25	1.27	1.29	1.32	1.34	1.36	1.38
sw by s	1.56	1.59	2. 2	2. 6	2. 9	2.13	2.16	2.20	2.24	2.26	2.29
s w	2.39	2 43	2.47	2.52	2.56	3. 1	3. 6	3.10	3.15	3.19	
sw by w	3.25	3.30	3.35	3.40	3.46	3.51	3.57	4. 3			
w s w	4.14	4.20	4.26	4.32	4.38						
w by s	5. 6	5.13	5.19								
Weſt	0. 0										
⊙ ſet	6. 0	5.45	5.30	5.15	5. 0	4.44	4.26	4. 8	3 49	3.33	3.19

A Sun-Dial for the Latitude of 57 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 10m	15 d	17 d 30m	20 d	22 d	23d. 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.38	0.37	0.36	0.35	0.34	0.32	0.31	0.30	0.29	0.28	0.27
s s w	1.17	1.14	1.12	1.10	1. 8	1. 6	1. 4	1. 1	0.59	0.57	0.55
sw by s	1.57	1.53	1.51	1.47	1.44	1.41	1.37	1.34	1.30	1.27	1.25
s w	2.40	2.36	2.32	2.27	2.23	2.18	2.14	2.10	1. 5	2. 1	1.58
sw by w	3.20	3.21	3.16	3.11	3. 5	3. 0	2.55	2.49	2.43	2.38	2.34
w s w	4.15	4. 9	4. 3	3.57	3.51	3.45	3.39	3.33	3.26	3.20	3.16
w by s	5. 7	5. 1	4.54	4.47	4.41	4.34	4.28	4.21	4.13	4. 7	4. 3
West	6. 0	5.53	5.47	5.40	5.33	5.27	5.20	5.12	5. 5	4.59	4.54
w by n				6.34	6.28	6.21	6.14	6. 7	6. 0	5.54	5.50
w n w						7.15	7. 9	7. 3	6.56	6.51	6.46
nw by w									7.51	7.47	7.43
n w											8.38
☉ ſet	6. 0	6.16	6.31	6.47	7. 3	7.20	7.38	7.56	8.16	8.34	8.48
Sun's Ampl.	d m 0 .0	d m 4.35	d m 9.11	d m 13.52	d m 18.33	d m 23.24	d m 28.22	d m 33.31	d m 38.53	d m 43.27	d m 47.2

6½ m) SOUTH DECLINATION. (9 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.38	0.39	0.40	0.41	0.42	0.43	0.44	0.46	0.47	0.48	0.49
s s w	1.17	1.19	1.21	1.23	1.25	1.27	1.30	1.32	1.34	1.36	1.38
sw by s	1.57	2. 0	2. 3	2. 7	2.10	2.13	2.17	2.20	2.24	2.27	2.29
s w	2.40	2.44	2.48	2.53	2.57	3. 2	3. 6	3.10	3.15	3.19	
sw by w	3.20	3.31	3.36	3.41	3.46	3.51	3.57	4. 3			
w s w	4.15	4.21	4.26	4.32	4.38						
w by s	5. 7	5.13	5.19								
West	6. 0										
☉ ſet	6. 0	5.44	5.29	5.13	4.57	4.40	4.22	4. 4	3.44	3.26	3.12

A Sun-Dial for the Latitude of 58 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.38	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0.29	0.28
s s w	1.17	1.15	1.13	1.11	1. 9	1. 7	1. 5	1. 2	1. 0	0.58	0.57
sw by s	1.58	1.55	1.52	1.49	1.46	1.42	1.39	1.36	1.32	1.29	1.27
s w	2.41	2.37	2.33	2.29	2.25	2.20	2.16	2.12	2. 7	2. 4	2. 1
sw by w	3.27	3.22	3.17	3.12	3. 7	3. 2	2.57	2.51	2.46	2.41	2.38
w s w	4.16	4.10	4. 5	3.59	3.53	3.47	3.41	3.35	3.29	3.23	3.19
w by s	5. 7	5. 1	4.55	4.49	4.43	4.30	4.30	4.23	4.16	4.10	4. 6
Weſt	6. 0	5.54	5.47	5.41	5.34	5.28	5.21	5.14	5. 8	5. 2	4.57
w by n				6.34	6.28	6.22	6.15	6. 8	6. 2	5.56	5.51
w n w						7.16	7.10	7. 3	6.57	6.52	6.48
nw by w								7.57	7.52	7.47	7.44
n w											8.38
☉ ſet	6. 0	6.16	6.32	6.49	7. 6	7.24	7.42	8. 1	8.22	8.41	8.57
Sun's	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
Ampl.	0. 0	4.43	9.26	14.16	19.7	24.6	29.14	34.34	40.12	44.59	48.41

6½ m) SOUTH DECLINATION. (9½ m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.38	0.39	0.40	0.41	0.43	0.44	0.45	0.46	0.47	0.48	0.49
s s w	1.17	1.19	1.22	1.24	1.26	1.28	1.30	1.32	1.35	1.37	1.38
sw by s	1.58	2. 1	2. 4	2. 7	2.10	2.14	2.17	2. 1	2.24	2.27	2.29
s w	2.41	2.45	2.49	2.53	2.57	3. 2	3. 6	3. 0	3.15	3.19	
sw by w	3.27	3.32	3.37	3.42	3.47	3.52					
w s w	4.16	4.21	4.27	4.33	4.38						
w by s	5. 7	5.13	5.19								
Weſt	6. 0										
☉ ſet	6. 0	5.44	5.28	5.11	4.54	4.36	4.18	3.59	3.38	3.19	3. 4

A Sun-Dial for the Latitude of 59 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.38	0.37	0.36	0.35	0.34	0.32	0.31	0.30	0.29	0.29
s s w	1.18	1.16	1.14	1.12	1.10	1. 8	1. 6	1. 4	1. 1	1. 0	0.58
sw by s	1.59	1.56	1.53	1.50	1.47	1.44	1.41	1.38	1.34	1.31	1.29
s w	2.42	2.38	2.35	2.31	2.27	2.23	2.19	2.14	2.10	2. 6	2. 3
sw by w	3.28	3.24	3.19	3.14	3. 9	3. 4	2.59	2.54	2 49	2.44	2.41
w s w	4.17	4.12	4. 6	4. 2	3.55	3.49	3.43	3.38	3.32	3.26	3.22
w by s	5. 8	5. 2	4.56	4.50	4.44	4.38	4.32	4.25	4.19	4.13	4. 9
Weſt	6. 0	5.54	5.48	5.42	5.35	5.29	5.23	5.16	5. 9	5. 4	4.59
w by n				6.35	6.29	6.22	6.16	6.10	6. 3	5.58	5.53
w n w						7.16	7.10	7. 4	6.58	6.53	6.49
								7.57	7.52	7.48	7.44
										8.43	8.38
⊙ ſet	6. 0	6.16	6.33	6.50	7. 8	7.27	7.46	8. 7	8.29	8.49	9. 5
Sun's Ampl.	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m	d m
	0. 0	4.51	9.43	14.41	19.41	24.51	30.12	35 43	41.37	46.40	50.42

6½m) SOUTH DECLINATION. 10m)

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49
s s w	1.18	1.20	1.22	1.24	1.26	1.28	1.31	1.33	1.35	1.3[illegible]	1.38
sw by s	1.59	2. 2	2. 5	2. 8	2.11	2.14	2.18	2.21	2.24	2.27	2.29
s w	2.42	2.46	2.50	2.54	2.58	3. 2	3. 6	3.11	3.15		
sw by w	3.28	3.33	3.38	3.43	3.47	3.52	3.57				
w s w	4.17	4.22	4.28	4.33	4.39						
w by s	5. 8	5.14	5.19								
Weſt	6. 0										
⊙ ſet	6. 0	5.44	5.27	5.10	4.52	4.33	4.14	3.53	3.31	3.11	2.55

A Sun-Dial for the Latitude of 60 Degrees.

NORTH DECLINATION.

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.38	0.37	0.36	0.35	0.34	0.33	0.32	0.31	0.30	0 29
s s w	1.19	1.17	1.15	1.13	1.11	1. 9	1. 7	1. 5	1. 3	1. 1	1. 0
sw by s	2. 0	1.57	1.54	1.51	1.48	1.45	1.42	1.39	1.36	1.33	1.31
s w	2.44	2.40	2.36	2.32	2.28	2.24	2.20	2.16	2.12	2. 8	2. 6
sw by w	3.29	3.25	3.20	3.16	3.11	3. 6	3. 1	2.56	2.51	2.47	2.44
w s w	4.18	4.13	4. 7	4. 2	3.57	3.51	3.46	3.40	3.34	3.29	3.25
w by s	5. 8	5. 3	4.57	4.51	4.45	4.40	4.34	4.27	4.21	4.16	4.12
West	6. 0	5.54	5.48	5.42	5.36	5.31	5.24	5.18	5.11	5. 6	5. 2
w by n				6.35	6.29	6.23	6.17	6.11	6. 4	5.59	5.55
w n w						7.16	7.10	7. 4	6 59	6.54	6.50
nw by w								7.57	7.52	7.48	7.45
n w										8.41	8.39
☉ ſet	6. 0	6.17	6.35	6.50	7.11	7.30	7.51	8.13	8.36	8.58	9.16
Sun's Ampl.	d m 0. 0	d m 5. 0	d m 10.2	d m 15.8	d m 20.18	d m 25.39	d m 31. 9	d m 36.58	d m 43.10	d m 48.32	d m 52.51

7m) SOUTH DECLINATION. (11 m

Deg. Min.	0 d	2 d 30m	5 d	7 d 30m	10 d	12 d 30m	15 d	17 d 30m	20 d	22 d	23 d 29m
Point	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m	h m
South	12	12	12	12	12	12	12	12	12	12	12
s by w	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49
s s w	1.19	1.21	1.23	1.25	1.27	1.29	1.31	1.33	1.35	1.37	1.38
sw by s	2. 0	2. 3	2. 6	2. 9	2.12	2.15	2.18	2.21	2.24	2.27	2.29
s w	2.44	2.47	2.51	2.55	2.59	3. 3	3. 7	3.11	3.15		
sw by w	3.29	3.34	3.39	3.43	3.48	3.53	3.58				
w s w	4.18	4.23	4.28	4.33	4.39						
w by s.	5. 8	5.14	5.20								
West	6. 0										
☉ ſet	6. 0	5.43	5.25	5. 8	4.49	4.30	4. 9	3.47	3.24	3. 2	2.44

The Deſcription and Uſe of the foregoing Sun-Dial TABLES.

THESE Tables are intitled at the Head of each Page thus: *A Sun-Dial for the Latitude of* 0 *Degree*; the next is, *A Sun-Dial for the Latitude of* 1 *Degree*, and ſo on orderly to 60 Degrees, making in all 61 Dials; from Page 24 to Page 84.

Each Dial hath two Tables, the upper for North Declination, the lower for South Declination, and 12 Columns in each Table: At the Head of each Column, and right againſt Deg. Min. are the Degrees of Declination thus; | 0d. | 2d. 30m. | 5d. | 7d. 30m. | 10d. 12d. 30m. | 15d. | 17d. 30m. | 20d. | 22d. | 23d. 29m. d. ſtanding for Degrees, and m. for Minutes.

Under thoſe Degrees and Minutes of Declination in each Column h. ſtands for Hours, and m. for Minutes of an Hour.

In the Left-hand Column of each Table under Points, at the Head, are the Points of the Compaſs, thus, South, S. by W. SSW. SW. by S. SW. *&c.* S. by W. ſtanding for South and by Weſt; SSW. for South South Weſt; SW. by S. for South Weſt by South, and ſo for the reſt.

At the Foot of each Table, is the Sun's Setting and Sun's Amplitude, agreeable to thoſe ſeveral Declinations at the Head of each Column; and are diſtinguiſhed from the reſt by the Words in the Left-hand Column, thus, ☉ ſet, Sun's Amplitude; or as much of them as the Column can contain. *Note*, the Sun's ſetting is annexed to each Table, but the Sun's Amplitude only to that for North Declination, becauſe it is the ſame as to Quantity for South Declination.

The Sun's ſetting is Hours and Minutes, but the Amplitude is Degrees and Minutes, having d, over the Degrees, and m, over the Minutes.

By theſe Tables may be known the Time of the Day, if the Sun can be ſet by the Compaſs, as true and exact as though he was upon the Meridian; Alſo his Riſing, Setting, and Amplitude. The like may be known by any Star, whoſe Declination doth not exceed 23d. 29m. as will be evident by the following Propoſitions.

Propoſition 1. THE Latitude of a Place, the Sun's Declination, and his Bearing being given; to find the Hour of the Day.

Note, By Bearing is meant the Azimuth or Point of the Compaſs the Sun is upon; which is to be found by the Azimuth Compaſs, in preference to the common Compaſs, and proper allowance muſt be made for the Variation.

The Solution of this Propoſition is thus;

1. Seek in the *Tables* for the neareſt given Latitude.
2. At the Head of the Table ſeek the given Declination, or the neareſt to it.
3. Find the given Bearing among the Points of the Compaſs in the Left-hand Column.
4. Then look ſtraight to the Right-hand of the Bearing, till you come right under the neareſt Declination in the Head of the Table, and the Number you find there is the Hour required.

Example 1. In the Latitude of 30 Degrees, the Sun having 15 Degrees North Declination, I deſire to know at what o'clock the Sun cometh upon the SW. Point of the Compaſs, the variation being allowed.

Look for the Table belonging to the Latitude of 30 Degrees, which is in Page 54, and in the Head thereof, ſeek for 15 Degrees in the Column under North Declination, and on the Left-hand Side for SW. and then in the common Angle of Meeting you will find the Hour of the Day to be 0h. 58m. that is 58 Min. paſt 12 o'Clock, the Time required.

Example 2. I deſire to know at what o'Clock the Sun cometh to the SW. in the Latitude of 30 Degrees, its Declination being 15 Degrees South? *Anſwer*, 34 Minutes paſt 2 o'Clock.

For if you turn to the Dial for Latitude 30 Degrees, in Page 54, and in the Table for South Declination ſeek 15d. at the Head of it, under which, and right againſt SW. on the Right-hand you will find 2h. 34m. the Time of the Day required.

If the Declination be more or leſs than the Declination in the Head of the Table; then look under that Declination which is neareſt to the Declination propoſed.

But more exactly thus, *Find the Hour for the next Declination both leſs and greater than the Declination propoſed*, and take the Difference of thoſe Hours, as alſo of the Declination belonging to them: Then ſay,

As the laſt Difference is to the firſt Difference; ſo is the Difference between the Declination propoſed and the next leſs in the Table, to a fourth proportional, which add to (*when the Hour in the Table increaſeth*) or (*when it decreaſeth*) ſubtract from the Hour belonging to the leſs Declination aforeſaid, and you will have the Hour required nearly exact to the Declination propoſed.

Example 3. Admit the Declination to be 18 Deg. 20 min. North, I deſire to know at what o'Clock the Sun cometh upon the WSW. Point of the Compaſs, in the Latitude of 30 Degrees?

In the Table, the neareſt Number to 18 Deg. 20 Min. is 17d. 30m. Then under 17d. 30m. and againſt WSW. is 1h. 42m. which ſheweth that the Sun cometh upon the WSW. Point of the Compaſs, at 42 Min. paſt one o'Clock.

Becauſe the Declination propoſed, is greater than the Declination in the Head of the Table; therefore you may make a Proportion very eaſily thus, under 17d. 30m. and againſt WSW. you will find

1h. 42m. and under 20d. you'll find 1h. 25m. the difference between theſe two Numbers is 17m. And the difference between the Declination 17d. 30m. and 20d. is 2d. 30m. or 150m. Alſo the difference between the Declination 18d. 20m. and 17d. 30m. is 50m. Then ſay, As 150m. is to 17m. ſo is 50m. to 6m. almoſt: Or, 50m. being the $\frac{1}{3}$ of 150m. nearly; the third part of 17m. may be taken and ſubtracted from 1h. 42m. (becauſe the Hour decreaſeth) and the Remainder 1h. 36m. is the true Hour of the Day, the Sun being upon the W. S W. Point of the Compaſs, having 18d. 20m. North Declination.

Do the like with any other Degrees and Minutes of Declination: But if the Declination be not very different from that in the Head of the Table, you need not make any Proportion: Likewiſe when the Sun is near the Meridian, you need not make any Proportion, becauſe there the difference is but ſmall.

Note, There are none but the *Afternoon Points* in the Tables of theſe *Dials*, yet you may eaſily find the Time of the Day for the *Forenoon Points* by what follows.

For Points equally diſtant from the Meridian, are equal Time from Noon, ſo that at what Space of Time from Noon the Sun is S.E. in the Forenoon, the like Space of Time from Noon it is S.W. Afternoon.

As in the Table following, the Points that ſtand right againſt one another, are equally diſtant from the Meridian; therefore to find the Hour of the Day, the Sun being upon any of the Forenoon Points; ſee what Time of the Day it is when the Sun is upon the Afternoon Points that ſtand right againſt the Forenoon Points deſired, and ſubtract thoſe Hours and Minutes from 12 Hours, the Remainder is the Hour and Minute of the Day required.

A TABLE *of the Points of the Compaſs, equally diſtant from the Meridian.*

Forenoon Points.	Afternoon Points.
South	South
South by Eaſt	South by Weſt
South South Eaſt	South South Weſt
South Eaſt by South	South Weſt by South
South Eaſt	South Weſt
South Eaſt by Eaſt	South Weſt by Weſt
Eaſt South Eaſt	Weſt South Weſt
Eaſt by South	Weſt by South
Eaſt	Weſt
Eaſt by North	Weſt by North
Eaſt North Eaſt	Weſt North Weſt
North Eaſt by Eaſt	North Weſt by Weſt
North Eaſt	North Weſt
North Eaſt by North	North Weſt by North
North North Eaſt	North North Weſt
North by Eaſt	North by Weſt
North	North
Forenoon Points.	Afternoon Points.

Example 4. In the Latitude of 60 Degrees, the Sun being North Eaſt; I demand the Hour of the Day, the Sun having 22 Degrees North Declination.

In the *Sun-Dial* for Latitude 60 Degrees, (in Page 84) look againſt NW. which is the *Afternoon Point*, correſponding to N.E. the *Forenoon Point*) and finding the Declination 22 Degrees in the Head of the Table, in the common Angle of Meeting is 8 Hours 41 Minutes, which ſubtract from 12 Hours, the Remainder 3 Hours 19 Minutes, is the Hour of the Day required in the Morning.

Example 5. The Sun being ENE. in the ſame Latitude with the ſame Declination; I demand the Hour of the Day?

In Latitude 60 Degrees, and North Declination 22 Degrees, the Sun being WNW. it is 54 Minutes paſt ſix o'Clock in the Afternoon; which ſubtract from 12 Hours, the Remainder is 6 Minutes paſt 5 in the Morning; the Time deſired.

Example 6. In the Latitude 35 Degrees North, the Sun having 15 Degrees North Declination; and being South Eaſt by Eaſt; I demand the Hour and Minute of the Day?

In the Table for Latitude 35 Degrees (in Page 59) look againſt S.W. by W. (the Afternoon Point) correſponding to SE. by E. (the Forenoon Point.) And the Declination 15d. at the Head of the Table, and in the common Angle of Meeting is 1h. 45m. which deducted from 12 Hours, the Remainder is 15 Min. paſt 10 o'Clock, the true Time of the Day deſired.

Example 7. In the Latitude 35 Degrees North, the Sun having 15 Degrees South Declination, and being SE. by E. I demand the Hour of the Day.

Anſwer, 20 Minutes paſt 8 o'clock; for the Hour in the Table is 3 Hours 40 Minutes, which ſubtracted from 12 Hours, leaveth 8 Hours 20 Minutes the Hour required.

The like is to be underſtood of any other Latitude, with any other Declination, and with any other Point of the Compaſs.

Note, Theſe Tables ſerve as well in *South Latitude*, as in *North Latitude*, the only Difference will be this:

If the Latitude be contrary, then the Declination muſt be contrary, and the Points of the Compaſs contrary; that is to ſay, North Declination muſt be counted South; and South Declination muſt be counted North; and the South
Point

Point muſt be North; and S. by W. muſt be N. by W. and S.S.W. muſt be N.N.W and S.W. by S. muſt be NW. by N. and ſo for any other Point, as in the following Table.

A TABLE of Points equally diſtant from Noon, both in North Latitude and in South Latitude, either before Noon or after Noon.

North Latitude		South Latitude	
Forenoon.	Afternoon.	Forenoon.	Afternoon.
S. by E.	S. by W.	N. by E.	N. by W.
S. S. E	S. S. W.	N. N. E.	N. N. W.
S. E. by S.	S. W. by S.	N. E. by N.	N. W. by N.
South Eaſt	South Weſt	North Eaſt	North Weſt.
S. E. by E.	S. W. by W.	N. E. by E.	N. W. by W.
E. S. E.	W. S. W.	E. N. E.	W. N. W.
E. by S.	W. by S.	E. by N.	W. by N.
Eaſt.	Weſt	Eaſt	Weſt
E by N.	W. by N.	E. by S.	W. by S.
E. N. E.	W. N. W.	E. S. E.	W. S. W.
N. E. by E.	N. W. by W.	S. E. by E	S. W. by W.
North Eaſt	North Weſt	South Eaſt	South Weſt.
N. E. by N.	N. W. by N.	S. E. by S.	S. W. by S.
N. N. E.	N. N. W.	S. S. E.	S. S. W.
N. by E.	N. by W.	S. by E.	S. by W.
North	North	South	South

Propoſition 2. *To find the Hour of the Night by the Stars, and the Tables of Sun-Dials.*

YOU may find the Hour of the Night by the Bearing of any known Star, whoſe Declination doth not exceed the Sun's greateſt Declination, after this Manner.

Find the Time of the Star's coming to the Meridian on the Day propoſed; then if the Star be on the Eaſt Side of the Meridian, ſubtract the Hours and Minutes which theſe Tables ſhew, from the Time of the Star's coming to the Meridian, the Remainder is the Hour of the Night: But if the Star be on the Weſt Side of the Meridian, then add thoſe Hours and Minutes aboveſaid, to the Time of the Stars coming to the Meridian, the Sum is the Hour of the Night.

To find what Time the Stars come upon or to the Meridian, ſee the *Mariner's Calendar*, in the Uſes of the Tables of the Sun's and Stars Right Aſcenſion, or *Seaman's Daily Aſſiſtant*.

Example 8. Admit the 26th of *October*, in the Latitude 40 Degrees North, I obſerve the *Bull's-Eye* or *Aldebaran* to be S.E. I demand the Hour of the Night?

The 26th of *October*, the *Bull's Eye* cometh on the Meridian at 21 Minutes paſt 2 o'Clock in the Morning; this Star's Declination is 16 Deg. N. nearly, therefore in the Table that belongs to 40 Degrees in Page 64, ſeek in the Head of the Table the Declination of the Star, or neareſt hereto, and by the Side, the Point of the Compaſs, and n the common Angle of Meeting, is 1h. 31m. which ſubract from 2h. 21m. the Star's Southing, the Remainder hours 50 min. is the Hour of the Night deſired. But if his Star had borne S.W. you muſt have added, and then he Hour would have been 52 min. paſt 3 o'Clock in the lorning.

The Operation.

	h. m.
he Time of the Stars being on the Meridian———	2 : 21
is Diſtance from the Meridian either at SE. or SW.	1 : 31
he Time of the Night, the Star being SE.———	0 : 50
he Time of the Night, the Star being SW.———	3 : 52

Example 9. Admit the 16th Day of *November*, in Latitude 45 Degrees North; I ſee the *Lion's Tail* upon the ESE. Point of the Compaſs, having Declination 15d. 57m. North, I demand the Hour of the Night.

The Operation.

	h. m.
Time of the Star's being on the Meridian	8 : 11 Morn.
His Diſtance from the Meridian being —	3 : 2
Time of the Night, the Star is E S. E.	5 : 09 Morn.
Time when this Star is W.S.W.	11 : 13 Morn.

Note, If the Compaſs hath Variation, you muſt allow for the Variation; but if you will uſe this following Inſtrument, which I call the Rectifier, you need not reckon which Way the Variation is, either Eaſtward or Weſtward; for this Inſtrument will do it ſo plain, that you cannot be miſtaken, as is ſhewn in the following Part of this Book: But for the preſent I will only give you one Propoſition, and apply it upon the Rectifier, which is as followeth:

Propoſition. Admit in Lat. 47 Deg. North, the Sun being in one of the Equinoctial Points, at which Time he hath no Declination, I obſerve the Sun to riſe upon the E.S.E. Point of the Compaſs, I demand the Variation?

When the Sun has no Declination, it riſes due Eaſt, and ſets due Weſt, all over the World; but according to the foregoing Propoſition, the Sun did riſe E.S.E. therefore there are two Points Variation, as will appear by the following Rectifier.

The Deſcription of the RECTIFIER.

THIS Inſtrument containeth two Circles or Compaſſes one within the other; but as it is made of Wood, the one moveth upon the other; ſo that the inward, or upper Circle repreſenteth the Compaſs that you ſteer by, which is ſubject to Variation: But the outward or under Circle repreſenteth a true Compaſs that never varieth. And by it you may readily rectify your Compaſs when it doth vary thus;

Always bring the true Point of Riſing or Setting on the outward or under Compaſs to touch the falſe Point of Riſing or Setting on the inward or upper Compaſs, there let the Inſtrument ſtand.

As in the foregoing *Propoſition*; The Eaſt Point is the true Point of Riſing, and ESE. Point is the falſe Point of Riſing; therefore bring the Eaſt Point on the outward or under Compaſs, to touch the ESE Point on the inward or upper Compaſs.

Then the Points that are on the outward or true Compaſs do explain the Points that are upon the inward or ſteering Compaſs; ſo that according to this Obſervation the NNE. Point on your Compaſs, is the true North Point; and the North is the true NNW. and the NW. is the true WNW. and the Weſt the true WSW. Point; as plainly appears by the Rectifier, ſee Page 135.

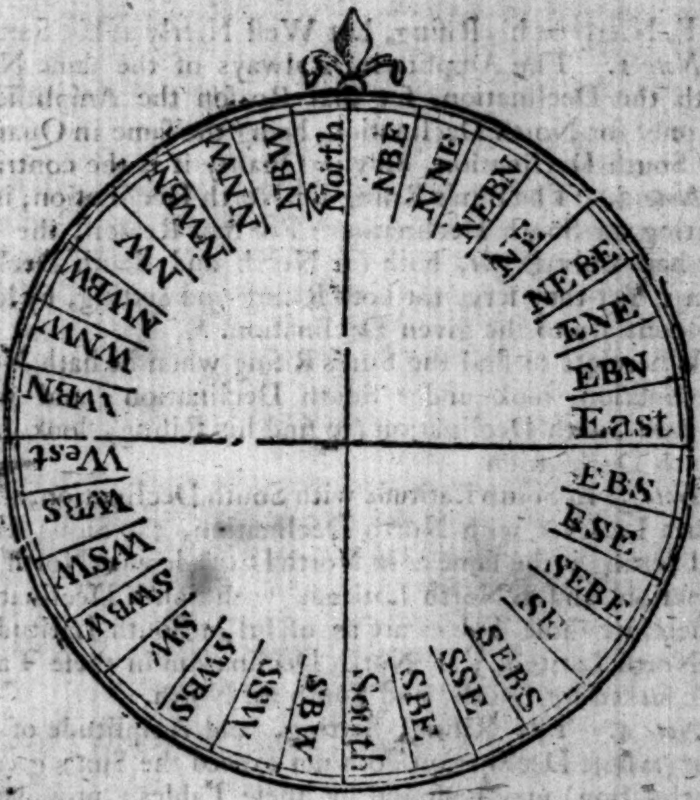
Note, The true Points are always counted on the outward Circle or Compaſs.

This Inſtrument in Wood, is larger than this Figure, and there the Points are divided into Halves and Quarters; as alſo each Compaſs (in ſome) is divided into 360 Degrees numbered from the North and South, (both ways) towards the Eaſt and Weſt, ending there in 90 Degrees.

A right Knowledge of the Quantity and Quality of the *Variation* of the Compaſs in different Latitudes and Longitudes, is of the utmoſt Importance, not only in the preceding Propoſition, but in all others where *Bearings* are required, and eſpecially in correcting the Courſes ſteered by a Ship at Sea; for which Purpoſe an accurate Variation Chart conſtructed from more than Fifty Thouſand actual Obſervations, by *William Mountaine*, F. R. S. is ſold by Meſſ. *Mount and Page*, on *Tower Hill*.

The

The RECTIFIER.



Propoſition 3. *To find the Sun's Riſing, Setting, or Amplitude by the Tables of the Sun Dials.*

IN the Table for the Latitude of the Place, ſeek the Declination, under which, and againſt ☉ *ſet*, is the Sun's Setting; and againſt *Sun*'s *Ampl.* is the Amplitude.

And if you ſubtract the Sun's Setting from 12 Hours, it gives its Riſing.

Example 10. Latitude 50 Degrees North, Sun's Declination 20 Degrees North, I demand his Riſing, Setting, and his Amplitude.

In the Table for 50 Degrees (in Page 74) ſeek the Declination 20 Degrees North at the Head of the Table, under which, and right againſt ☉ *ſet* is 7.43, which ſheweth the Sun ſetteth at 43 Min. after 7 in the Afternoon; which ſubtract from 12h. the Remainder 4h. 17m. is its Riſing.

In like Manner under the Sun's Declination 20d. and againſt Sun's Amp. is 32d. 8m. the Sun's Amplitude; that is, E. N.erly at his Riſing, but Weſt N.erly at his Setting.

Note 1. The Amplitude is always of the ſame Name with the Declination, for that Reaſon the Amplitude is ſet only for North Declination, being the ſame in Quantity for South Declination, only in Quality it is the contrary.

Note 2. The Sun's Riſing for North Declination, is the Setting for South Declination: For that Reaſon, the Table hath only ☉ *ſet*, both for North and South Declination: Yet they ſerve for both Riſing and Setting, by looking contrary to the given Declination.

Wherefore to find the Sun's Riſing when he hath North Declination, look under South Declination; and when he hath South Declination (to find his Riſing) look under North Declination

Note 3. In South Latitude with South Declination, alſo in South Latitude with North Declination, the Sun's Riſing and Setting is the ſame as in North Latitude with North Declination, and in North Latitude with South Declination. Therefore thoſe Tables are as uſeful in South Latitude as in North Latitude; if North Declination in theſe Tables be counted for South, and South for North.

Note 4. The Riſing, Setting, and Amplitude of any Star (whoſe Declination doth not exceed the Sun's greateſt Declination) may be found by theſe Tables; provided its Southing, or Time of the Star's coming to or on the Meridian, be known.

For the Time of Sun-ſetting in theſe Tables for any Latitude, is a Star's half Continuance above the Horizon, having equal Declination, and the ſame kind with the Sun for the ſame Latitude.

Therefore the half Continuance of a Star above the Horizon (found in theſe Tables as before directed) added to, and ſubtracted from the Time of the Star's coming to or on the Meridian; the firſt is the Star's Setting, and the latter its Riſing.

Examples of this Nature you will find in the Uſe of the next Tables of Semidiurnal and Seminocturnal Arches, to which you are referred.

The Amplitude of a Star by the foregoing Tables is found as the Amplitude of the Sun was, which is more fully treated of in the Uſe of the Table of Amplitude in Page 146.

The Sun, on account of Refraction appears to riſe ſooner and ſet later than by the preceding Tables, which are calculated for the appearance of the Sun's Center in the Horizon independent of Refraction, which at the Horizon is 33m. or ſomething more than the Sun's Diameter.

In this Edition; to every Degree of Latitude the effect of the horizontal Refraction, at the Sun's riſing and ſetting is noticed in Minutes of Time, before and after the words SOUTH DECLINATION, which Minutes are to be ſubtracted from the Time of Riſing, and added to the Sun's ſetting as found by the Tables: The Figures on the left hand, are the effect of Refraction when the Sun has no Declination, and thoſe on the right are for the Sun's greateſt Declination either North or South. Now in Example the 10th, Page 95, the Sun's ſetting, is foundto be 7h. 43m. and the riſing 4h. 17m. but the Effect of the Refraction, for the greateſt Declination in Latitude 50 Degrees is 6½m. and may be eſtimated about 6m. for the given Declination, viz. 20 Degrees, conſequently the Sun will appear to ſet about 49 Minutes paſt 7 o'Clock, and to riſe 11 Minutes after 4. This is a Correction worth Notice to thoſe who wiſh to regulate their Watches by the riſing and ſetting of the Sun's upper Limb, for which the Corrections above mentioned are made.

Aſtronomic TABLES of Semidiurnal and Seminocturnal Arches: Shewing the true Time of the Sun's Riſing and Setting; with the Length of the Day and Night, for any Day in the Year; fitting all Places in the World, where the Pole is not elevated above 60 Degrees, either North or South; and to laſt with Exactneſs, as long as God upholdeth the Courſe of Nature.

A TABLE ſhewing the Semidiurnal Arch, or Time of Sun-ſetting, when the Sun hath North Declination; and the Seminoctural Arch, or Time of Sun-riſing, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Decli.	1		2		3		4		5		6	
	H	M	H	M	H	M	H	M	H	M	H	M
0	6	0	6	0	6	0	6	0	6	0	6	0
1	6	0	6	0	6	0	6	0	6	0	6	0
2	6	0	6	0	6	0	6	0	6	1	6	1
3	6	0	6	0	6	1	6	1	6	1	6	1
4	6	0	6	0	6	1	6	1	6	1	6	2
5	6	0	6	0	6	1	6	1	6	2	6	2
6	6	0	6	1	6	1	6	2	6	2	6	3
7	6	0	6	1	6	1	6	2	6	2	6	3
8	6	0	6	1	6	2	6	2	6	3	6	3
9	6	1	6	1	6	2	6	3	6	3	6	4
10	6	1	6	1	6	2	6	3	6	4	6	4
11	6	1	6	1	6	2	6	3	6	4	6	5
12	6	1	6	2	6	2	6	3	6	4	6	5
13	6	1	6	2	6	3	6	4	6	5	6	6
14	6	1	6	2	6	3	6	4	6	5	6	6
15	6	1	6	2	6	3	6	4	6	5	6	6
16	6	1	6	2	6	3	6	5	6	6	6	7
17	6	1	6	2	6	4	6	5	6	6	6	7
18	6	1	6	3	6	4	6	5	6	7	6	8
19	6	1	6	3	6	4	6	5	6	7	6	8
20	6	1	6	3	6	4	6	6	6	7	6	9
21	6	2	6	3	6	5	6	6	6	8	6	9
22	6	2	6	3	6	5	6	6	6	8	6	10
23	6	2	6	3	6	5	6	7	6	9	6	10
29	6	2	6	4	6	5	6	7	6	9	6	11

Degrees of Declination.

A TABLE ſhewing the Semidiurnal Arch, or Time of Sun ſetting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun riſing, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Decl. Degrees of Declination.	7		8		9		10		11		12	
	H	M	H	M	H	M	H	M	H	M	H	M
0	6	0	6	0	6	0	6	0	6	0	6	0
1	6	0	6	0	6	1	6	1	6	1	6	1
2	6	1	6	1	6	1	5	1	6	2	6	2
3	6	1	6	2	6	2	6	2	6	2	6	3
4	6	2	6	2	6	2	6	3	6	3	6	3
5	6	2	6	3	6	3	6	4	6	4	6	4
6	6	3	6	3	6	4	6	4	6	5	6	5
7	6	3	6	4	6	4	6	5	6	5	6	6
8	6	4	6	4	6	5	6	6	6	6	6	7
9	6	4	6	5	6	6	6	6	6	7	6	8
10	6	5	6	6	6	6	6	7	6	8	6	9
11	6	5	6	6	6	7	6	8	6	9	6	9
12	6	6	6	7	6	8	6	9	6	9	6	10
13	6	6	6	7	6	8	6	9	6	10	6	11
14	6	7	6	8	6	9	6	10	6	11	6	12
15	6	8	6	9	6	10	6	11	6	12	6	13
16	6	8	6	9	6	10	6	12	6	13	6	14
17	6	9	6	10	6	11	6	12	6	14	6	15
18	6	9	6	10	6	12	6	13	6	14	6	16
19	6	10	6	11	6	13	6	14	6	15	6	17
20	6	10	6	12	6	14	6	15	6	16	6	18
21	6	11	6	12	6	14	6	16	6	17	6	19
22	6	11	6	13	6	15	6	16	6	18	6	20
23	6	12	6	14	6	15	6	17	6	19	6	21
23.29	6	12	6	14	6	16	6	17	6	19	6	21

A TABLE ſhewing the Semidiurnal Arch, or Time of Sun ſetting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun riſing, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Decl.	13		14		15		16		17		18	
	H	M	H	M	H	M	H	M	H	M	H	M
0	6	0	6	0	6	0	6	0	6	0	6	0
1	6	1	6	1	6	1	6	1	6	1	6	1
2	6	2	6	2	6	2	5	2	6	2	6	2
3	6	3	6	3	6	3	6	3	6	4	6	4
4	6	4	6	4	6	4	6	5	6	5	6	5
5	6	5	6	5	6	5	6	6	6	6	6	6
6	6	6	6	6	6	6	6	7	6	7	6	8
7	6	6	6	7	6	7	6	8	6	9	6	9
8	6	7	6	8	6	9	6	9	6	10	6	10
9	6	8	6	9	6	10	6	10	6	11	6	12
10	6	9	6	10	6	11	6	12	6	12	6	13
11	6	10	6	11	6	12	6	13	6	13	6	14
12	6	11	6	12	6	13	6	14	6	15	6	16
13	6	12	6	13	6	14	6	15	6	16	6	17
14	6	13	6	14	6	15	6	16	6	17	6	19
15	6	14	6	15	6	16	6	18	6	19	6	20
16	6	15	6	16	6	18	6	19	6	20	6	21
17	6	16	6	17	6	19	6	20	6	21	6	22
18	6	17	6	19	6	20	6	21	6	23	6	24
19	6	18	6	20	6	21	6	23	6	24	6	26
20	6	19	6	21	6	22	6	24	6	25	6	27
21	6	20	6	22	6	24	6	25	6	27	6	29
22	6	21	6	23	6	25	6	27	6	28	6	30
23	6	22	6	24	6	26	6	28	6	30	6	32
23.29	6	23	6	25	6	27	6	29	6	31	6	33

Degrees of Declination.

A TABLE ſhewing the Semidiurnal Arch, or Time of Sun-ſetting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-riſing, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Decli Degrees of Declination	19		20		21		22		23		24	
	H	M	H	M	H	M	H	M	H	M	H	M
0	6	0	6	0	6	0	6	0	6	0	6	0
1	6	1	6	1	6	1	6	2	6	2	6	2
2	6	3	6	3	6	3	6	3	6	3	6	3
3	6	4	6	4	6	5	6	5	6	5	6	5
4	6	5	6	6	6	6	6	6	6	7	6	7
5	6	7	6	7	6	8	6	8	6	9	6	9
6	6	8	6	9	6	9	6	10	6	10	6	11
7	6	10	6	10	6	11	6	11	6	12	6	13
8	6	11	6	12	6	12	6	13	6	14	6	14
9	6	13	6	13	6	14	6	15	6	15	6	16
10	6	14	6	15	6	16	6	16	6	17	6	18
11	6	15	6	16	6	17	6	18	6	19	6	20
12	6	17	6	18	6	19	6	20	6	21	6	22
13	6	18	6	19	6	20	6	21	6	23	6	24
14	6	20	6	21	6	22	6	23	6	24	6	25
15	6	21	6	22	6	24	6	25	6	26	6	27
16	6	23	6	24	6	25	6	27	6	28	6	29
17	6	24	6	25	6	27	6	28	6	30	6	31
18	6	26	6	27	6	29	6	30	6	32	6	33
19	6	27	6	29	6	30	6	32	6	34	6	35
20	6	28	6	30	6	32	6	34	6	36	6	37
21	6	30	6	32	6	34	6	36	6	37	6	39
22	6	31	6	33	6	35	6	37	6	39	6	41
23	6	33	6	35	6	37	6	39	6	41	6	43
23.29	6	34	6	36	6	38	6	40	6	42	6	44

A TABLE ſhewing the Semidiurnal Arch, or Time of Sun-ſetting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-riſing, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Decli	25		26		27		28		29		30	
Degrees of Declination	H	M	H	M	H	M	H	M	H	M	H	M
0	6	0	6	0	6	0	6	0	6	0	6	0
1	6	2	6	2	6	2	6	2	6	2	6	2
2	6	4	6	4	6	4	6	4	6	4	6	5
3	6	6	6	6	6	6	6	6	6	7	6	7
4	6	7	6	8	6	8	6	9	6	9	6	9
5	6	9	6	10	6	10	6	11	6	11	6	12
6	6	11	6	12	6	12	6	13	6	13	6	14
7	6	13	6	14	6	14	6	15	6	16	6	16
8	6	15	6	16	6	16	6	17	6	18	6	19
9	6	17	6	18	6	19	6	19	6	20	6	21
10	6	19	6	20	6	21	6	22	6	23	6	23
11	6	21	6	22	6	23	6	24	6	25	6	26
12	6	23	6	24	6	25	6	26	6	27	6	28
13	6	25	6	26	6	27	6	28	6	29	6	31
14	6	27	6	28	6	29	6	30	6	32	6	33
15	6	29	6	30	6	31	6	33	6	34	6	36
16	6	31	6	32	6	34	6	35	6	37	6	38
17	6	33	6	34	6	36	6	37	6	39	6	41
18	6	35	6	36	6	38	6	40	6	42	6	43
19	6	37	6	39	6	40	6	42	6	44	6	46
20	6	39	6	41	6	43	6	45	6	47	6	48
21	6	41	6	43	6	45	6	47	6	49	6	51
22	6	43	6	45	6	48	6	50	6	52	6	54
23	6	46	6	48	6	50	6	52	6	54	6	57
23.29	6	47	6	49	6	51	6	53	6	55	6	58

A TABLE ſhewing the Semidiurnal Arch, or Time of Sun-ſetting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-riſing, when the Sun hath South Declination.

The Degrees of Latitude.

Degrees of Declination.

Sun's Decli.	31		32		33		34		35		36	
	H	M	H	M	H	M	H	M	H	M	H	M
0	6	0	6	0	6	0	6	0	6	0	6	0
1	6	2	6	2	6	3	6	3	6	3	6	3
2	6	5	6	5	6	5	6	5	6	6	6	6
3	6	7	6	8	6	8	6	8	6	8	6	9
4	6	10	6	10	6	10	6	11	6	11	6	12
5	6	12	6	13	6	13	6	14	6	14	6	15
6	6	15	6	15	6	16	6	16	6	17	6	18
7	6	17	6	18	6	18	6	19	6	20	6	20
8	6	19	6	20	6	21	6	22	6	23	6	23
9	6	22	6	23	6	24	6	25	6	25	6	26
10	6	24	6	25	6	26	6	27	6	28	6	29
11	6	27	6	28	6	29	6	30	6	31	6	32
12	6	29	6	31	6	32	6	33	6	34	6	36
13	6	32	6	33	6	34	6	36	6	37	6	39
14	6	34	6	36	6	37	6	39	6	40	6	42
15	6	37	6	39	6	40	6	42	6	43	6	45
16	6	40	6	41	6	43	6	45	6	46	6	48
17	6	42	6	44	6	46	6	48	6	49	6	51
18	6	45	6	47	6	49	6	51	6	53	6	55
19	6	48	6	50	6	52	6	54	6	56	7	58
20	6	51	6	53	6	55	6	57	6	59	7	1
21	6	53	6	56		58	7	0	7	2	7	5
22	6	56	6	58	7	1	7	3	7	6	7	8
23	6	59	7	1	7	4	7	6	7	9	7	12
23,29	7	1	7	3	7	6	7	8	7	11	7	14

A TABLE ſhewing the Semidiurnal Arch, or Time of Sun-ſetting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-riſing, when the Sun hath South Declination.

The Degrees of Latitude.

Degrees of Declination.

Sun's Decli.	37		38		39		40		41		42	
	H	M	H	M	H	M	H	M	H	M	H	M
0	6	0	6	0	6	0	6	0	6	0	6	0
1	6	3	6	3	6	3	6	3	6	3	6	4
2	6	6	6	6	6	6	6	7	6	7	6	7
3	6	9	6	9	6	10	6	10	6	10	6	11
4	6	12	6	13	6	13	6	13	6	14	6	14
5	6	15	6	16	6	16	6	17	6	17	6	18
6	6	18	6	19	6	20	6	20	6	21	6	22
7	6	21	6	22	6	23	6	24	6	25	6	25
8	6	24	6	25	6	26	6	27	6	28	6	29
9	6	27	6	28	6	29	6	31	6	32	6	33
10	6	31	6	32	6	32	6	34	6	35	6	37
11	6	34	6	35	6	36	6	38	6	39	6	40
12	6	37	6	38	6	40	6	41	6	43	6	44
13	6	40	6	42	6	43	6	45	6	46	6	48
14	6	43	6	45	6	47	6	48	6	50	6	52
15	6	47	6	48	6	50	6	52	6	54	6	56
16	6	50	6	52	6	54	6	56	6	58	7	0
17	6	53	6	55	6	57	7	0	7	2	7	4
18	6	57	6	59	7	1	7	3	7	6	7	8
19	7	0	7	2	7	5	7	7	7	10	7	12
20	7	4	7	6	7	9	7	11	7	14	7	17
21	7	7	7	10	7	12	7	15	7	18	7	21
22	7	11	7	14	7	16	7	19	7	22	7	25
23	7	15	7	17	7	20	7	23	7	27	7	30
23,29	7	17	7	19	7	22	7	25	7	29	7	32

A TABLE ſhewing the Semidiurnal Arch, or Time of Sun-ſetting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-riſing, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Decli.	43		44		45		46		47		48	
Degrees of Declination.	H	M	H	M	H	M	H	M	H	M	H	M
0	6	0	6	0	6	0	6	0	6	0	6	0
1	6	4	6	4	6	4	6	4	6	4	6	4
2	6	7	6	8	6	8	6	8	6	9	6	9
3	6	11	6	12	6	12	6	12	6	13	6	13
4	6	15	6	15	6	16	6	17	6	17	6	18
5	6	19	6	19	6	20	6	21	6	22	6	22
6	6	22	6	23	6	24	6	25	6	26	6	27
7	6	26	6	27	6	28	6	29	6	30	6	31
8	6	30	6	31	6	32	6	33	6	35	6	36
9	6	34	6	35	6	36	6	38	6	39	6	41
10	6	38	6	39	6	41	6	42	6	43	6	45
11	6	42	6	43	6	45	6	46	6	48	6	50
12	6	46	6	47	6	49	6	51	6	53	6	55
13	6	50	6	52	6	53	6	55	6	57	6	59
14	6	54	6	56	6	58	7	0	7	2	7	4
15	6	58	7	0	7	2	7	4	7	7	7	9
16	7	2	7	4	7	7	7	9	7	12	7	14
17	7	6	7	9	7	11	7	14	7	17	7	19
18	7	11	7	13	7	16	7	19	7	22	7	25
19	7	15	7	18	7	21	7	24	7	27	7	30
20	7	19	7	22	7	25	7	29	7	32	7	35
21	7	24	7	27	7	30	7	34	7	37	7	41
22	7	28	7	31	7	35	7	39	7	43	7	47
23	7	33	7	36	7	40	7	44	7	48	7	53
23.29	7	36	7	39	7	43	7	47	7	51	7	56

A TABLE ſhewing the Semidiurnal Arch, or Time of Sun-ſetting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-riſing, when the Sun hath South Declination.

The Degrees of Latitude.

Sun's Decli.	49		50		51		52		53		54	
	H	M	H	M	H	M	H	M	H	M	H	M
0	6	0	6	0	6	0	6	0	6	0	6	0
1	6	5	6	5	6	5	6	5	6	5	6	6
2	6	9	6	10	6	10	6	10	6	11	6	11
3	6	14	6	14	6	15	6	15	6	16	6	17
4	6	18	6	19	6	20	6	21	6	21	6	22
5	6	23	6	24	6	25	6	26	6	27	6	28
6	6	28	6	29	6	30	6	31	6	32	6	33
7	6	32	6	34	6	35	6	36	6	38	6	39
8	6	37	6	39	6	40	6	41	6	43	6	45
9	6	42	6	44	6	45	6	47	6	49	6	50
10	6	47	6	49	6	50	6	52	6	54	6	56
11	6	52	6	54	6	56	6	58	7	0	7	2
12	6	57	6	59	7	1	7	3	7	6	7	8
13	7	2	7	4	7	6	7	9	7	11	7	14
14	7	7	7	9	7	12	7	14	7	17	7	20
15	7	12	7	14	7	17	7	20	7	23	7	28
16	7	17	7	20	7	23	7	26	7	29	7	33
17	7	22	7	25	7	29	7	32	7	36	7	40
18	7	28	7	31	7	35	7	38	7	42	7	46
19	7	33	7	37	7	41	7	45	7	49	7	52
20	7	39	7	45	7	47	7	51	7	56	8	0
21	7	45	7	49	7	53	7	58	8	3	8	8
22	7	51	7	55	8	0	8	5	8	10	8	15
23	7	57	8	2	8	6	8	12	8	17	8	23
23.29	8	0	8	5	8	10	8	16	8	21	8	27

Degrees of Declination.

A TABLE ſhewing the Semidiurnal Arch, or Time of Sun-ſetting, when the Sun hath North Declination; and the Seminocturnal Arch, or Time of Sun-riſing, when the Sun hath South Declination.

The Degrees of Declination.

Snn's Decl.	55		56		57		58		59		60	
	H	M	H	M	H	M	H	M	H	M	H	M
0	6	0	6	0	6	0	6	0	6	0	6	0
1	6	6	6	6	6	6	6	6	6	7	6	7
2	6	11	6	12	6	12	6	13	6	13	6	14
3	6	17	6	18	6	19	6	19	6	20	6	21
4	6	23	6	24	6	25	6	26	6	27	6	28
5	6	29	6	30	6	31	6	32	6	33	6	35
6	6	35	6	36	6	37	6	39	6	40	6	42
7	6	40	6	42	6	44	6	45	6	47	6	49
8	6	46	6	48	6	50	6	52	6	54	6	56
9	6	52	6	54	6	56	6	59	7	1	7	4
10	6	58	7	0	7	3	7	6	7	8	7	11
11	7	54	7	7	7	10	7	13	7	16	7	19
12	7	11	7	13	7	16	7	20	7	23	7	26
13	7	17	7	20	7	23	7	27	7	30	7	34
14	7	23	7	27	7	30	7	34	7	38	7	42
15	7	30	7	34	7	38	7	42	7	46	7	51
16	7	37	7	41	7	45	7	49	7	54	7	59
17	7	44	7	48	7	52	7	57	8	3	8	8
18	7	51	7	55	8	0	8	15	8	11	8	17
19	7	58	8	3	8	8	8	14	8	20	8	26
20	8	5	8	11	8	16	8	22	8	29	8	36
21	8	13	8	19	8	25	8	32	8	39	8	47
22	8	21	8	27	8	34	8	41	8	49	8	58
23	8	29	8	36	8	43	8	51	9	0	9	9
32,29	8	33	8	41	8	48	8	56	9	5	9	16

Degrees of Declination.

The USE of the foregoing TABLES of Semidiurnal and Seminocturnal Arches.

To find the Time of the Sun's Riſing and Setting, and the Length of the Day and Night, by theſe Tables.

FIRST, ſeek the Sun's Declination in the Tables of Declination for the Day propoſed; with which enter the Tables of Semidiurnal and Seminocturnal Arches; finding the Latitude of the Place in the Head of the Table, and the Degrees of the Sun's Declination in the firſt Column on the Left-hand; and in the common Angle of Meeting is the Semidiurnal Arch, if the Sun hath North Declination; but its Seminocturnal Arch, if the Sun hath South Declination.

Example 1. Let it be required to find the Time of the Sun's Riſing and Setting, the Length of the Day and Night, for the 4th of May 1786, in Latitude 46 Degrees North.

At which Time the Sun's Declination is 16 deg. 4 min. North; with which enter the Table, as before mentioned, and the Semidiurnal Arch is 7 Hours 9 Min. the true Time of Sun-ſetting; whoſe Complement to 12 Hours is the Seminocturnal Arch, or the Time of the Sun-riſing, and is 4 Hours 51 Minutes; double the Semidiurnal Arch you have the Length of the Day; double the Seminocturnal Arch, the Sum is the Length of the Night. See the Work following.

	H.	M.
	12 :	0
The Semidiurnal Arch, or Time of Sun-ſetting -	7 :	9
The Complement to 12 Hours is - - - - -	4 :	51

The Seminocturnal Arch, or Time of Sun-riſing, in Latitude 46 Degrees North, is 4 Hours 51 Minutes.

The

	M.
The Semidiurnal Arch double - - - - - -	7 : 9 7 : 9
The Length of the Day, May 4, 1786, is	14 : 18
The Seminocturnal Arch doubled - - - - -	4 : 51 4 : 51
The Length of the Night, May 4, 1786, is———	9 : 42

Example 2. But when the Sun hath 16 deg. 4 min. South Deelination, in the Latitude of 46 deg. North; then the Day Arch will become the Night Arch, and the Night-Arch will become the Day-Arch.

As, on Nov. 6, 1787, the Sun hath 16 deg. 3 min. South Declination; then the Time of the Sun's Riſing is 7 Hours 9 Minutes, his Setting 4 Hours 51 Minutes; the Length of the Day 9 Hours 42 Minutes, and the Length of the Night 14 Hours 18 Minutes.

Example 3. Let it be required to find the Time of the Sun's Riſing and Setting, with the Length of the Day and Night for the 26th of December, 1791, in Latitude 53 deg. North; at which Time the Sun's Declination is 23 deg. 23 min. South.

	H. M
	12 : 0
The Seminocturnal Arch, or Time of Sun-riſing—	8 : 20
The Complement to 12 Hours is - - - - -	3 : 40

And is the Semidiurnal Arch, or Time of Sun-ſetting.

The Semidiurnal Arch doubled - - - - - -	3 : 40 3 : 40
The Length of the Day December 26, 1791, is	7 : 20
The Seminocturnal Arch doubled - - - -	8 : 20 8 : 20
The Length of the Night, Dec, 26, 1791 ——	16 : 40

The

Theſe Tables will ſerve as well in South Latitude as in North, with this Alteration only: When in South Latitude, then uſe South Declination there, as you do North Declination here in North Latitude.

For then theſe Tables ſhew the Semidiurnal Arch, or the Time of Sun-riſing, when the Sun hath South Declination; and the Seminocturnal Arch, or the Time of Sun-ſetting, when the Sun hath North Declination.

Example 4. Let it be required to find the Time of the Sun's Riſing and Setting, with the Length of the Day and Night, for the 4th of May, 1787, in Latitude 46 Degrees South.

At which Time the Sun's Declination is 16 Degrees 1 Minute North; with which enter the Table, and the Seminocturnal Arch is 7 Hours 9 Minutes the Time of Sun riſing; whoſe Complement 12 Hours is the Semidiurnal Arch, or Time of Sun-ſetting, which is at 51 Minutes paſt 4 of the Clock.

	H:	M.
The Seminocturnal doubled	7	9
	7	9
The Length of the Night, May, 4, 1787, in Latitude 46 Degrees South	14	18
The Semidiurnal Arch doubled	4	51
	4	51
The Length of the Day, the 4th of May, 1787. Latitude 46 Degrees South	9	42

Example 5. Let it be required to find the Time of the Sun's Riſing and Setting, with the Length of the Day and Night, for the 11th of December, 1787, in Latitude 53 Degrees South. At which Time the Sun's Declination is 23 deg. 3 min. South; with which enter the Table of Semidiurnal Arches *&c*, and you will find as follows.

	H.	M.
The Semidiurnal Arch, or Time of Sun-ſetting	12	0
	8	17
The Seminocturnal Arch, or Time of Sun-riſing	3	43
The Length of the Day	16	34
Length of the Night, December 11, 1787 Latitude 53 Degrees South	7	26

Obſerve, the ſame allowance for the effect of Refraction muſt be made, in the following Examples, as directed in Page 97, for the Apparent riſing and ſetting of the Sun's upper Limb; and the Day will always be longer, and the Night ſhorter by twice the effect of Refraction, and the Time that the Sun's Semidiameter is paſſing the Horizon.

Refer to Example the 3d of theſe Tables, (Page 109) where the Sun's riſing is 8h. 20m. ſetting 3h. 40m. length of the Day 7h. 20m; of the Night 16h. 40m. but the effect of Refraction being allow'd (as in the Tables of Sun-Dials for Latitude 46 Degrees and Declination 16) which is about 5½m: The Sun's riſing will be 8h. 14½m. ſetting 7h. 25½; length of the Day 7h. 31m. and of the Night 16h. 29m. from the firſt to the laſt appearance of the Sun's Limb.

To find the Time of a Star's Riſing or Setting.

BY theſe Tables the Time of the Riſing and Setting of all the Stars in the Heavens (whoſe Declination does not exceed the Sun's greateſt Declination,) in any Latitude that the Tables contain, and at any Time of the Year, is found in this Manner.

If the Star hath North Declination, and you are in North Latitude, look for the Latitude in the Head of the Table, the Declination on the Left-hand, and in the common Angle of Meeting is the Star's Semiapparent Arch, or half the Time of the Star's Continuance above the Horizon, in that Latitude; or the Space of Time which that Star takes in aſcending from the Horizon to the Meridian, on the Eaſt-ſide; likewiſe deſcending from the Meridian, to the Horizon, on the Weſt-ſide of the Meridian. Now, if you ſubtract theſe Hours and Minutes from the Time of the Star's coming to the Meridian, the Remainder will be the Time of the Star's Riſing: And if you add, the Sum will be the true Time of the Star's Setting.

Example 6. Let it be required to find the Time of the Riſing and Setting of the *Bull's Eye*, November the 30th in the Latitude of 52 Degrees North: The Declination of the Star being 16 deg. North; the 30th Day of November this Star cometh on the Meridian at 58 Minutes paſt 11 of the Clock at Night.

H. M.
The Time of the Star's Southing - - - - - 11 : 58
The Semi-apparent Arch, ſubtract - - - - - 7 : 26

The Time of the Star's Riſing in the Evening - 4 : 32

Time of the Star's Setting in the Morning - - 7 : 24

Note 1. If the Sum exceed 12 Hours, caſt away 12 Hours; the Remainder is the Star's Setting.

2. And when you can't ſubtract, add 12 Hours to the Star's Southing, and then ſubtract: What remains is its Riſing.

Example 7. I deſire to know the Time of the Riſing and Setting of the Bull's Eye, the 30th Day of November, in the Latitude of 13 Degrees North: The Declination of the Bull's Eye 16 deg. 4 min. North?

H. M.
The Time of the Star's Southing - - - - - 11 : 58
The Semi-apparent Arch ſubtract - - - - - 6 : 15

The Time of his Riſing in the Evening - - - 5 : 43

The Time of his Setting in the Morning - - 6 : 13

If the Star hath South Declination, and you are in North Latitude, look (as before) the Latitude in the Head of the Table, the Declination on the Left-ſide, and in the common Angle of Meeting is the Star's Semi-depreſſed Arch: which ſubtract from 12 Hours, the Remainder is the Star's Semi-apparent Arch, or half the Time that the Star doth continue above the Horizon in that Latitude: Therefore ſubtract thoſe Hours and Minutes from the Time of the Star's coming to the Meridian, adding 12 Hours to the Star's Southing, if otherwiſe Subtraction cannot be made, the Remainder will be the Time of the Star's Riſing; and if you add, the Sum will be the Time of the Star's Setting.

Example 8. Let it be required to find the Time of the Riſing and Setting of *Sirius* the Bright Star in the *Great Dog's Mouth*, the 15th Day of *November*, in the Latitude of 50 deg. North. The Declination is 16d. 25m. South, and its Southing is 3 Hours, 13 min. in the Morning, the 15th of *November*.

	H. M.
The Time of the Star's Southing is	3 : 13
To it add	12 : 0
The Sum is	15 : 13
The Semi-depreſſed Arch, by the Table is	7 : 22
Which ſubtract from	12 : 0
The Remainder is the Semi-apparent Arch	4 : 38
Time of Southing with 12 Hours added is	15 : 13
The Semi-apparent Arch ſubtract	4 : 38
Time of the Star's Riſing in the Evening	10 : 35
Time of the Star's Setting from Noon, or 51 min. paſt 7 in the Morning	19 : 51

Example 9. I deſire to know the Riſing and Setting of the *Great Dog*, the 15th of *November*, in the Latitude of 30 Degrees North.

	H. M.
Time of Southing with 12 Hours added	15 : 13
Subtract from	12 : 0
The Semi-depreſſed Arch, by the Table,	6 : 39
Remainder of the Semi-apparent Arch	5 : 21
Time of Southing, with 12 Hours added, is	15 : 13
Subtract, gives the Time of the Star's riſing in the Evening	9 : 52
Added, gives the Star's ſetting in the Morning, when 12 Hours are ſubtracted	8 : 34

In South Latitude, to know the Time of Riſing and Setting of the Stars.

Proceed with thoſe Stars that have North Declination in South Latitude, as with Stars that have South Declination in North Latitude.

Example 10. Let it be required to find the Time of the Riſing and Setting of the *Bull's Eye* the 18th Day of *November*, in the Latitude of 42 Degrees South.

The Declination of this Star is 16 Deg. 4 min. North: the 18th Day of *November*, this Star cometh upon the Meridian at 49 min. paſt 12 in the Morning.

	H.	M.
The Semi-depreſs'd Arch, by the Table is	7	0
Which ſubtract from	12	0
The Remainder is the Semi-apparent Arch	5	0
The Time of the Star's Northing is	12	49
The Semi-apparent Arch, ſubtract	5	0
Time of the Star's Riſing in the Evening	7	49
Time of the Star's Setting in the Morning	5	49

In like Manner the riſing and ſetting of any Star (whoſe Declination exceedeth not the Sun's greateſt) may be found in any Latitude, from the Equinoctial to 60 Degrees, either North or South.

ASTRONOMIC TABLES.

Shewing the Points and Quarter-Points of the Compaſs, *that the* Sun *and* Stars *Riſe and Set upon.*

Being of excellent Uſe for readily finding the Variation of the Compaſs; and may be performed by an ordinary Meridian Compaſs, but more exactly by an Azimuth Compaſs;

Calculated for all Parts of the World, where the Pole is not elevated above 60 Deg. either North or South.

Latitude 0 Degree.

North Dec		Dec.	South Dec.	
☉ ri	☉ ſet	d. m.	☉ ri	☉ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.49	1	
2		5.37	2	
3		8.26	3	
e b n	w b n	11.15	e b s	w b s
1		14. 4	1	
2		16.52	2	
3		19.41	3	
e n e	w n w	22.30	e s e	w s w

Latitude 1 Degree

North Dec.		Dec.	South Dec	
☉ ri	☉ ſet	d. m.	☉ ri	☉ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.49	1	
2		5.37	2	
3		8.26	3	
e b n	w b n	11.15	e b s	w b s
1		14. 4	1	
2		16.52	2	
3		19.41	3	
e n e	w n w	22 30	e s e	w s w

Latitude 2 Degrees.

North Dec		Dec.	South Dec.	
☉ ri	☉ ſet	d. m.	☉ ri	☉ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.49	1	
2		5 37	2	
3		8 26	3	
e b n	w b n	11 15	e b s	w b s
1		14. 4	1	
2		16.52	2	
3		19 40	3	
e n e	w n w	22.29	e s e	w s w

Latitude 3 Degrees.

North Dec.		Dec.	South Dec.	
☉ ri	☉ ſet	d. m.	☉ ri	☉ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.49	1	
2		5.37	2	
3		8.25	3	
e b n	w b n	11.14	e b s	w b s
1		14. 3	1	
2		16.51	2	
3		19.39	3	
e n e	w n w	21.27	e s e	w s w

Latitude 4 Degrees.

North Dec.		Dec.	South Dec.	
⊙ ri	⊙ ſet	d. m	⊙ ri	⊙ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.48	1	
2		5.37	2	
3		8.25	3	
e b n	w b n	11.14	e b s	w b s
1		14. 2	1	
2		16.50	2	
3		19.38	3	
e n e	w n w	22.25	e s e	w s w

Latitude 5 Degrees.

North Dec.		Dec.	South Dec	
⊙ ri	⊙ ſet	d. m	⊙ ri	⊙ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2 48	1	
2		5.36	2	
3		8 24	3	
e b n	w b n	11.12	e b s	w b s
1		14. 1	1	
2		16.49	2	
3		19.36	3	
e n e	w n w	22.23	e s e	w s w

Latitude 6 Degrees.

North Dec.		Dec.	South Dec.	
ri	⊙ ſet	d. m.	⊙ ri	ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.48	1	
2		5.36	2	
3		8.23	3	
e b n	w b n	11.11	e b s	w b s
1		13.59	1	
2		16.47	2	
3		19.33	3	
e n e	w n w	22.21	e s e	w s w

Latitude 7 Degrees.

North Dec.		Dec.	South Dec.	
ri	⊙ ſet	d. m,	⊙ ri	⊙ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.48	1	
2		5.35	2	
3		8.22	3	
e b n	w b n	11. 9	e b s	w b s
1		13.57	1	
2		16.45	2	
3		19 32	3	
e n e	w n w	22.19	e s e	w s w

Latitude 8 Degrees.

North Dec.		Decl.	South De	
⊙ri	⊙ſet	d. m	⊙ri	⊙ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.47	1	
2		5.35	2	
3		8 21	3	
ebn	wbn	11. 8	ebs	wbs
1		13.55	1	
2		16.42	2	
3		19.29	3	
ene	wnw	22.16	eſe	wſw

Latitude 9 Degrees.

North Dec		Decl.	South Dec.	
⊙ri	⊙ſet	d. m.	⊙ri	⊙ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.47	1	
2		5.33	2	
3		8 20	3	
ebn	wbn	11. 6	ebs	wbs
1		13.53	1	
2		16.40	2	
3		19.26	3	
ene	wnw	22.12	eſe	wſw

Latitude 10 Degrees.

North Dec.		Dec.	South Dec.	
⊙ri	⊙ſet	d. m.	⊙ri	⊙ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.46	1	
2		5.32	2	
3		8.18	3	
ebn	wbn	11. 4	ebs	wbs
1		13.50	1	
2		16.37	2	
3		19 22	3	
ene	wnw	22. 8	eſe	wſw

Latitude 11 Degrees.

North Dec.		Dec.	South Dec	
⊙ri	⊙ſet	d. m.	⊙ ri	⊙ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.46	1	
2		5.31	2	
3		8.17	3	
ebn	wbn	11. 3	ebs	wbs
1		13.48	1	
2		16 33	2	
3		19.18	3	
ene	wnw	22. 3	eſe	wſw

Latitude 12 Degrees

North Dec.		Dec.	South Dec.	
☉ ri	☉ ſet	d. m.	ri	☉ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.45	1	
2		5.38	2	
3		8 15	3	
e b n	w b n	11. 0	e b s	w b s
1		13.45	1	
2		16.30	2	
3		19 14	3	
e n e	w n w	21.58	e s e	w s w

Latitude 13 Degrees

North Dec.		Dec.	South Dec.	
☉ ri	☉ ſet	d. m.	ri	☉ ſet
Eaſt	Weſt	0 0	Eaſt	Weſt.
1		2.45	1	
2		5.29	2	
3		8.13	3	
e b n	w b n	10.57	e b s	w b s
1		13.42	1	
2		16.26	2	
3		19 10	3	
e n e	w n w	21.52	e s e	w s w

Latitude 14 Degrees.

North Dec.		Dec.	South Dec.	
☉ ri	☉ ſet	d. m.	☉ ri	☉ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.44	1	
2		5.28	2	
3		8.11	3	
e b n	w b n	10.55	e b s	w b s
1		13.38	1	
2		16.22	2	
3		19. 4	3	
e n e	w n w	21.47	e s e	w s w

Latitude 15 Degrees.

North Dec.		Dec.	South Dec.	
ri	☉ ſet	d. m	☉ ri	☉ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.43	1	
2		5.26	2	
3		8. 6	3	
e b n	w b n	10.52	e b s	w b s
1		13.35	1	
2		16.17	2	
3		18.59	3	
e n e	w n w	21.41	e s e	w s w

Latitude 16 Degrees.

North Dec.	Dec.	South Dec.
☉ri | ☉ſet	d. m.	☉ri | ☉ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.42	1
2	5.25	2
3	8. 6	3
e b n w b n	10.49	e b s w b s
1	13.31	1
2	16.12	2
3	18.53	3
e n e w n w	21.34	e s e w s w

Latitude 17 Degrees.

North Dec.	Dec.	South Dec.
☉ri | ☉ſet	d. m.	☉ri | ☉ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2 42	1
2	5.23	2
3	8. 4	3
e b n w b n	10.46	e b s w b s
1	13.26	1
2	16. 8	2
3	18.47	3
e n e w n w	21.27	e s e w s w

Latitude 18 Degrees.

North Dec.	Dec.	South Dec.
☉ri | ☉ſet	d. m.	☉ri | ☉ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.41	1
2	5.21	2
3	8. 1	3
e b n w b n	10.42	e b s w b s
1	13.22	1
2	16. 2	2
3	18.40	3
e n e w n w	21.20	e s e w s w

Latitude 19 Degrees.

North Dec.	Dec.	South Dec.
☉ri | ☉ſet	d. m.	☉ri | ☉ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.40	1
2	5.19	2
3	7.58	3
e b n w b n	10.38	e b s w b s
1	13.17	1
2	15 56	2
3	18.34	3
e n e w n w	21.13	e s e w s w

Latitude 20 Degrees.

North Dec.	Dec.	South Dec.
☉ ri ☉ ſet	d. m.	☉ ri ☉ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.38	1
2	5.17	2
3	7.55	3
e b n w b n	10.34	e b s w b s
1	13.12	1
2	15.49	2
3	18.27	3
e n e w n w	21. 4	e s e w s w

Latitude 21 Degrees.

North Dec	Dec	South Dec.
☉ ri ☉ ſet	d. m.	☉ ri ☉ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.38	1
2	5 15	2
3	7.52	3
e b n w b n	10.30	e b s w b s
1	13. 7	1
2	15.43	2
3	18.20	3
e n e w n w	20.55	e s e w s w
1	23.32	1

Latitude 22 Degrees.

North Dec.	Dec.	South Dec
☉ ri ☉ ſet	d. m.	☉ ri ☉ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.37	1
2	5.13	2
3	7.49	3
e b n w b n	10.25	e b s w b s
1	13. 1	1
2	15.37	2
3	18.12	3
e n e w n w	20.46	e s e w s w
1	23.21	1

Latitude 23 Degrees.

North Dec.	Dec.	South e
☉ ri ☉ ſet	d. m	☉ ri ☉ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.36	1
2	5.11	2
3	7.46	3
e b n w b n	10.21	e b s w b s
1	12.56	1
2	15.31	2
3	18. 3	3
e n e w n w	20.37	e s e w s w
1	23.11	1

Latitude 24 Degrees

North Dec.		Dec.	South Dec.	
⊙ ri	⊙ ſet	d. m.	⊙ ri	⊙ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.34	1	
2		5. 8	2	
3		7.42	3	
e b n	w b n	10.16	e b s	w b s
1		12.50	1	
2		15.23	2	
3		17.55	3	
e n e	w n w	20.27	e s e	w s w
1		23. 0	1	

Latitude 25 Degrees

North Dec.		Dec	South Dec.	
⊙ ri	⊙ ſet	d. m.	⊙ ri	⊙ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.33	1	
2		5 5	2	
3		7.38	3	
e b n	w b n	10.11	e b s	w b s
1		12.43	1	
2		15.15	2	
3		17.46	3	
e n e	w n w	20.17	e s e	w s w
1		22.46	1	

Latitude 26 Degrees.

North Dec.		Dec.	South Dec.	
⊙ ri	⊙ ſet	d. m.	⊙ ri	⊙ ſet
Eaſt	weſt	0. 0	Eaſt	Weſt
1		2.34	1	
2		5. 3	2	
3		7.35	3	
e b n	w b n	10. 6	e b s	w b s
1		12.36	1	
2		15. 8	2	
3		17.37	3	
e n e	w n w	20. 6	e s e	w s w
1		22.36	1	

Latitude 27 Degrees.

North Dec.		Dec.	South Dec	
⊙ ri	⊙ ſet	d. m	⊙ ri	⊙ ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.30	1	
2		5. 0	2	
3		7.31	3	
e b n	w b n	10. 1	e b s	w b s
1		12.30	1	
2		15. 0	2	
3		17.28	3	
e n e	w n w	19.55	e s e	w s w
1		22.23	1	

Latitude 28 Degrees

North Dec.	Dec.	South Dec.
⊙ ri | ⊙ ſet	d. m.	⊙ ri | ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.29	1
2	4.56	2
3	7.27	3
e b n w b n	9.55	e b s w b s
1	12.23	1
2	14.51	2
3	17.18	3
e n e w n w	19.44	e s e w s w
1	22.11	1

Latitude 29 Degrees

North Dec.	Dec	South Dec.
⊙ ri | ⊙ ſet	d. m.	⊙ ri | ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.28	1
2	4.55	2
3	7.22	3
e b n w b n	9.50	e b s w b s
1	12.16	1
2	14.43	2
3	17. 8	3
e n e w n w	19.32	e s e w s w
1	21.58	1

Latitude 30 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri | ⊙ ſet	d. m.	⊙ ri | ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.27	1
2	4.52	2
3	7.18	3
e b n w b n	9.44	e b s w b s
1	12. 9	1
2	14.34	2
3	16.57	3
e n e w n w	19.20	e s e w s w
1	21.44	1

Latitude 31 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri | ⊙ ſet	d. m.	⊙ ri | ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.25	1
2	4.50	2
3	7.13	3
e b n w b n	9.38	e b s w b s
1	12. 1	1
2	14.25	2
3	16.47	3
e n e w n w	19. 8	e s e w s w
1	21.30	1

Latitude 32 Degrees.

North Dec.		Decl.	South Dec.	
☉ri	☉ſet	d. m.	☉ri	☉ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2. 3	1	
2		4.46	2	
3		7. 8	3	
ebn	wbn	9.31	ebs	wbs
1		11.54	1	
2		14.15	2	
3		16.36	3	
ene	wnw	18.55	ese	wsw
1		21.16	1	

Latitude 33 Degrees.

North Dec.		Decl.	South Dec.	
☉ri	☉ſet	d. m.	☉ri	☉ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.22	1	
2		4.43	2	
3		7. 4	3	
ebn	wbn	9.25	ebs	wbs
1		11.46	1	
2		14. 6	2	
3		16.24	3	
ene	wnw	18.43	ese	wsw
1		21. 1	1	
2		23.17	2	

Latitude 34 Degrees.

North Dec.		Dec.	South Dec.	
☉ri	☉ſet	d. m.	☉ri	☉ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.20	1	
2		4.40	2	
3		6.59	3	
ebn	wbn	9.18	ebs	wbs
1		11.38	1	
2		13.56	2	
3		16.13	3	
ene	wnw	18.29	ese	wsw
1		20.46	1	
2		23. 0	2	

Latitude 35 Degrees.

North Dec.		Dec.	South Dec	
☉ri	☉ſet	d. m.	☉ ri	ſet
Eaſt	Weſt	0. 0	Eaſt	Weſt
1		2.18	1	
2		4.37	2	
3		6.54	3	
ebn	wbn	9.12	ebs	wbs
1		11.29	1	
2		13.46	2	
3		16. 2	3	
ene	wnw	18.16	ese	wsw
1		20.30	1	
2		22.43	2	

Latitude 36 Degrees.

North Dec.	Decl.	South Dec.
☉ri | ☉ſet	d. m.	☉ri | ☉ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.16	1
2	4.33	2
3	6 49	3
ebn wbn	9. 5	ebs wbs
1	11.20	1
2	13.35	2
3	15.49	3
ene wnw	18. 2	ese wsw
1	20.15	1
2	22.25	2

Latitude 37 Degrees.

North Dec.	Decl.	South Dec.
☉ri | ☉ſet	d. m.	☉ri | ☉ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.15	1
2	4 30	2
3	6.43	3
ebn wbn	8.58	ebs wbs
1	11.12	1
2	13.25	2
3	15.36	3
ene wnw	17.47	ese wsw
1	19.58	1
2	22. 7	2

Latitude 38 Degrees.

North Dec.	Dec.	South Dec.
☉ri | ☉ſet	d. m.	☉ri | ☉ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2.13	1
2	4.26	2
3	6.38	3
ebn wbn	8.50	ebs wbs
1	11. 3	1
2	13.14	2
3	15.23	3
ene wnw	17.32	ese wsw
1	19.41	1
2	21.49	2

Latitude 39 Degrees.

North Dec.	Dec.	South Dec.
☉ri | ☉ſet	d. m.	☉ri | ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2 11	1
2	4 22	2
3	6.32	3
ebn wbn	8.43	ebs wbs
1	10.53	1
2	13. 3	2
3	15 10	3
ene wnw	17.17	ese wsw
1	19.25	1
2	21.30	2
3	23.32	3

Latitude 40 Degrees.

North Dec.	Dec.	South Dec.
☉ ri | ☉ ſet	d. m.	☉ ri | ☉ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2. 9	1
2	4.19	2
3	6.27	3
ebn wbn	8.36	ebs wbs
1	10.43	1
2	12.51	2
3	14.57	3
ene wnw	17. 2	ese wsw
1	19. 7	1
2	21.10	2
3	23.11	3

Latitude 41 Degrees.

North Dec.	Dec.	South Dec.
☉ ri | ☉ ſet	d. m.	☉ ri | ☉ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2. 7	1
2	4.15	2
3	6.22	3
ebn wbn	8.28	ebs wbs
1	10.34	1
2	12.40	2
3	14.44	3
ene wnw	16.47	ese wsw
1	18.50	1
2	20.51	2
3	22.50	3

Latitude 42 Degrees.

North Dec.	Dec.	South Dec.
☉ ri | ☉ ſet	d.m.	☉ ri | ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2. 5	1
2	4.11	2
3	6.16	3
ebn wbn	8.20	ebs wbs
1	10.24	1
2	12.28	2
3	14.30	3
ene wnw	16.31	ese wsw
1	18.32	1
2	20.31	2
3	22.27	3

Latitude 43 Degrees

North Dec.	Dec.	South Dec.
☉ ri | ☉ ſet	d.m.	☉ ri | ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2. 3	1
2	4. 7	2
3	6.10	3
ebn wbn	8.12	ebs wbs
1	10.14	1
2	12.16	2
3	14.16	3
ene wnw	16.15	ese wsw
1	18.14	1
2	20.10	2
3	22. 5	3

Latitude 44 Degrees.

North Dec.	Dec.	South Dec.
⊙ri ⊙ſet	d. m.	⊙ri ⊙ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2. 1	1
2	4. 3	2
3	6. 4	3
ebn wbn	8. 4	ebs wbs
1	10. 4	1
2	12. 3	2
3	14. 1	3
ene wnw	15,59	ese wsw
1	17.54	1
2	19 50	2
3	21.42	3
nebenwbw	23.34	sebe swbw

Latitude 45 Degrees.

North Dec.	Dec.	South Dec.
⊙ri ⊙ſet	d. m.	⊙ri ⊙ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	2. 0	1
2	3.59	2
3	5.57	3
ebn wbn	7.56	ebs wbs
1	9.54	1
2	11.51	2
3	13.46	3
ene wnw	15.42	ese wsw
1	17.36	1
2	19.28	2
3	21.19	3
nebenwbw	23. 8	sebe swbw

Latitude 46 Degrees.

North Dec.	Dec.	South Dec.
⊙ri ⊙ſe	d.m.	⊙ri ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.58	1
2	3.55	2
3	5.51	3
ebn wbn	7.47	ebs wbs
1	9.43	1
2	11.38	2
3	13.32	3
ene wnw	15.25	ese wsw
1	17.17	1
2	19. 7	2
3	20.55	3
nebenwbw	22.42	sebeswbw

Latitude 47 Degrees.

North Dec.	Dec.	South Dec.
⊙ri ⊙ſet	d.m	⊙ri ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.55	1
2	3.50	2
3	5.45	3
ebn wbn	7.39	ebs wbs
1	9.33	1
2	11.25	2
3	13.17	3
ene wnw	15. 7	ese wsw
1	16.57	1
2	18.45	2
3	20.31	3
nebenwbw	22.16	sebe swbw

Latitude 48 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri | ⊙ ſet	d. m	⊙ ri | ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.53	1
2	3.46	2
3	5.38	3
e b n w b n	7.30	e b s w b s
1	9.22	1
2	11.12	2
3	13. 1	3
e n e w n w	14.50	e s e w s w
1	16 38	1
2	18.24	2
3	20. 7	3
nebenwbw	21.49	sebe swbw
1	23.29	1

Latitude 49 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri | ⊙ ſet	d. m.	⊙ ri | ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.51	1
2	3.42	2
3	5.31	3
e b n w b n	7.22	e b s w b s
1	9.10	1
2	10.59	2
3	12.46	3
e n e w n w	14 32	e s e w s w
1	16.17	1
2	18. 1	2
3	19.42	3
nebe nwbw	21.22	sebe swbw
1	23. 1	1

Latitude 50 Degrees.

North Dec	Dec.	South Dec.
⊙ ri | ⊙ ſet	d. m.	⊙ ri | ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.48	1
2	3 37	2
3	5.25	3
e bn w bn	7.12	e b s w b s
1	8.59	1
2	10.46	2
3	12.30	3
e n e w n w	14.14	e s e w s w
1	15.57	1
2	17.39	2
3	19.18	3
nebenwbw	20.55	sebe swbw
1	22.31	1
		2
		3

Latitude 51 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri | ⊙ ſet	d. m.	⊙ ri | ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.46	1
2	3.33	2
3	5 18	3
e b n w b n	7. 4	e b s w b s
1	8.48	1
2	10.32	2
3	12.14	3
e n e w n w	13.56	e s e w s w
1	15.36	1
2	17.16	2
3	18.52	3
nebenwbw	20.28	se be swbw
1	22. 1	1
2	23.32	2

Latitude 52 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri ⊙ ſet	d. m.	⊙ ri ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.44	1
2	3.27	2
3	5.11	3
e b n w b n	6.54	e b s w b s
1	8.36	1
2	10.18	2
3	11.58	3
e n e w n w	13.37	e s e w s w
1	15.16	1
2	16.52	2
3	18.27	3
nebenwbw	20. 0	sebe swbw
1	21.31	1
2	23. 0	2

Latitude 53 Degrees.

North Dec.	Dec.	South Dec.
⊙ ri ⊙ ſet	d. m	⊙ ri ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.42	1
2	3.23	2
3	5. 4	3
e b n w b n	6.44	e b s wbs
1	8.25	1
2	10. 4	2
3	11.42	3
e ne w n w	13.19	ese wsw
1	14 55	1
2	16.29	2
3	18. 1	3
nebe nwbw	19.32	sebe sw b w
1	21. 1	1
2	22.27	2

Latitude 54 Degrees.

North Dec	Dec.	South Dec.
⊙ ri ⊙ ſet	d. m.	⊙ ri ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1 39	1
2	3 18	2
3	4.57	3
e bn w bn	6.35	e b s wbs
1	8.13	1
2	9.50	2
3	11.23	3
ene wnw	13 0	e s e w s w
1	14 33	1
2	16. 5	2
3	17 35	3
nebenwbw	19. 5	sebe swbw
1	20.30	1
2	21.54	2
3	23.15	3

Latitude 55 Degrees

North Dec.	Dec.	South Dec
⊙ ri ⊙ ſet	d. m,	⊙ ri ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.37	1
2	3.13	2
3	4 49	3
e bn wbn	6.25	e bs w b s
1	8. 1	1
2	9 35	2
3	11. 8	3
e n e w nw	12.41	e s e wsw
1	14.12	1
2	15.42	2
3	17. 9	3
nebenwbw	18.35	se be swbw
1	19.59	1
2	21.21	2
3	22.39	3

Latitude 56 Degrees.

North Dec. ⊙ ri | ⊙ ſet	Dec. d. m.	South Dec. ⊙ ri | ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.34	1
2	3. 9	2
3	4.42	3
ebn wbn	6.16	ebs wbs
1	7.49	1
2	9.21	2
3	10.51	3
ene wnw	12.22	ese wsw
1	13.50	1
2	15.18	2
3	16.42	3
nebe nwbw	18. 6	sebe swbw
1	19.28	1
2	20.47	2
3	22. 3	3
ne nw	23.18	se sw

Latitude 57 Degrees

North Dec. ⊙ ri | ⊙ ſet	Dec. d. m.	South Dec ⊙ ri | ⊙ ſet
Eaſt Weſt	0. 0	Eaſt Weſt
1	1.32	1
2	3. 4	2
3	4.35	3
ebn wbn	6. 6	ebs wbs
1	7.36	1
2	9. 6	2
3	10.34	3
ene wnw	12. 1	ese wsw
1	13.28	1
2	14.53	2
3	16.16	3
nebe nwbw	17.37	sebe swbw
1	18.56	1
2	20.13	2
3	21.27	3
ne nw	22.30	se sw

Latitude 58 Degrees

Eaſt Weſt	0. 0	Eaſt Weſt
1	1.30	1
2	2.59	2
3	4.28	3
ebn wbn	5.56	ebs wbs
1	7.24	1
2	8.51	2
3	10.17	3
ene wnw	11.42	ese wsw
1	13. 6	1
2	14.28	2
3	15.48	3
nebe nwbw	17. 7	sebe swbw
1	18.24	1
2	19.39	2
3	20.51	3
ne nw	22. 0	se sw
1	23. 8	1

Latitude 59 Degrees

Eaſt Weſt	0 0	Eaſt Weſt
1	1.27	1
2	2.54	2
3	4.20	3
ebn wbn	5.46	ebs wbs
1	7.11	1
2	8.36	2
3	10. 0	3
ene wnw	11.22	ese wsw
1	12.44	1
2	14. 3	2
3	15.21	3
nebenwbw	16,37	sebeswbw
1	17,52	1
2	19. 4	2
3	20.14	3
ne nw	21,22	sw
1	22,26	1
2	23,27	2

Latitude 60 Degrees.

North Declination.			South Declination.		
⊙ riſe	D. M	⊙ ſet	⊙ riſe	D. M.	⊙ ſet
Eaſt	0. 0	Weſt	Eaſt	0. 0	Weſt
1	1.25	1	1	1.25	1
2	2.49	2	2	2.49	2
3	4.12	3	3	4.12	3
e by n	5.36	w by n	e by s	5.36	w by s
1	6 59	1	1	6.59	1
2	8.21	2	2	8.21	2
3	9.42	3	3	9.42	3
e n e	11. 2	w n w	e s e	11. 2	w s w
1	12.21	1	1	12.21	1
2	13.38	2	2	13.38	2
3	14.53	3	3	14.53	3
n e by e	16. 8	nwbyw	s e by e	16. 8	s w by s
1	17.20	1	1	17.20	1
2	18.30	2	2	18.30	2
3	19.38	3	3	19.38	3
n e	20.42	n w	s e	20.42	s w
1	21.45	1	1	21.45	1
2	22.45	2	2	22.44	2

The Deſcription and Uſe of the foregoing TABLES.

1. THESE Tables of the Points of the Compaſs, for the Sun, or any Star whoſe Declination exceeds not 23 deg. 29m. begin at Latitude 0 deg. and proceed orderly to 60 deg. each Page, except the laſt, containing four Tables, in all 61 Tables.

2. In each Table are five Columns; the middle contains the Degrees of Declination, either North or South; thoſe two on each Side of it, marked ⊙ riſe ⊙ ſet (under North or S. Declination) ſtanding for Sun-riſing and Sun-ſetting.

3. On each ſide the Declination under *North Declination*, and *South Declination*, are the reſpective Points of the Compaſs, upon which the Sun or Star riſes, that has the ſame Declination which ſtands againſt the correſponding Point and Quarter Point of the Compaſs, which are to be read

and underſtood, Thus: *Eaſt*, *Weſt*, under which is 1, 2, 3; that is *Eaſt* or *Weſt* 1 Quarter, 2 Quarters, 3 Quarters *Northerly* or *Southerly*; then E. by N. W. by N. under, which is 1, 2, 3; that is E. by N. or W. by N. 1 Quarter, 2 Quarters *Northerly*, &c.

Theſe Tables are ready Helps for finding the Variation of the Compaſs with Eaſe, and ſufficient Exactneſs, as is evident from the following Explanation.

To find the Point of the Compaſs that the Sun riſeth or ſetteth with, at any Time of the Year.

FIRST, ſeek the Sun's Declination in the Table of Declination for the Time propoſed; with which enter the foregoing Table, finding the Latitude in the Head of the Table, and the Declination in the third Column; againſt which, on the Left-hand, if it be North Declination, but on the Right-hand if it be South Declination, is the Point of the Compaſs that the Sun riſes or ſets upon, according to the Titles at the Head of the Table.

Note, Theſe Tables ſhew the true Points of the Sun's Riſing and Setting; ſo that you may readily know at any Time, ſeeing the Sun riſe or ſet, the Variation by a common ſteering Compaſs.

There are ſome Compaſſes not touched ſo well as they ought to be; others in Time will grow weak, or loſe their magnetic Virtue.

Now by theſe foregoing Tables you may very readily diſcover any of theſe Defects.

It may indeed be objected, they cannot ſee the Sun by an ordinary Meridian Compaſs, ſo near as is required.

To this I anſwer, it's as eaſy to ſet the Sun by the Compaſs, as to ſteer a Ship by it; for expert Seamen can ſet the Sun, or Headland, to the neareſt Quarter of a Point by their Hand, (but with Sights much nearer the Truth.) The Poſture to obſerve in ſuch Caſe, I adviſe, is thus:

Set the Compaſs about two Feet high, and directing your Hand towards the Sun, note what Point, Half Point, or Quarter Point, the Sun riſeth or ſetteth on; then in that Table belonging to the Latitude, ſee whether the Sun riſeth or ſets that Day upon the ſame Point, found by Ob-

Obſervation; if they agree, there is no Variation; but if they do not agree, the Compaſs is not true, or there is Variation; and the Variation is as much, as is the Difference between the Obſervation and the Table.

Example 1. Admit in Latitude 30 Degrees North, the Sun having 9 Degrees 44 Minutes North Declination; I obſerve the Sun that Day to riſe upon the E.N.E. Point of the Compaſs. I demand the Variation.

In the Head of the foregoing Tables, look for the Latitude 30 Degrees; and in the third Column for 9 deg. 44 min. North Declination; and againſt it (under ⊙ riſe) is E. by N. which ſheweth that there is one Point Variation. For it appears by the Table, that the E.N.E. Point on the Compaſs is the true E. by N. Point; and the E. by N. (as it is upon the Compaſs) is the true E. Point; the Eaſt Point is the true E. by S. the S.E. is the S.E. by S. and the South is the S. by W. the W. is the W. by N. and the North is the N. by E.

This plainly appears by the *Rectifier*, if you bring the E. by N. on the outward Circle, right againſt the E.N.E. on the inward Circle.

Now ſuppoſe we were to obſerve the Sun at his ſeting, in the Latitude of 30 deg. with Declination 9 deg. 44 min. North as aboveſaid, we ſhould find the Sun to ſet exactly at Weſt by the Compaſs, although in the Morning we did find the Sun to riſe at E.N.E. I know this will appear a Contradiction to ſome; but if you caſt your Eye upon the *Rectifier*, you may ſee it is a certain Truth.

Example 2. In Latitude 37 deg. North, the Sun's Declination 8 deg. 58 min. North, I obſerve the Sun to riſe E. by N. by the Compaſs; I demand the Variation.

In the Table that belongs to 37 deg. againſt 8 deg. 58 min. North Declination, and under ⊙ riſe is E. by N. which ſheweth there is no Variation, becauſe the Obſervation agrees with the Tables.

Note, If the Declination for the Day propoſed be not the ſame with the Declination in the Tables, then have Regard to the neareſt, allowing for the Difference, by the Rule of Proportion.

Example 3. In the Latitude 37 deg. North, ſuppoſe the Sun's Declination 10 deg. 15 min. North, I demand the Point of the Compaſs the Sun then riſeth upon?

In the Tables neareſt to 10 deg. 15 min. is 11 deg. 12. min. againſt which the Sun riſeth E. by N. a Quarter N. and ſets W. by N. a Quarter N. but in the Tables for 37 deg. Latitude, the Declination propoſed is near about the middle, between 8 deg. 58 min. and 11 deg. 12 min. Therefore the Sun riſeth E. by N. half a Quarter N. and ſetteth W. by N. half a Quarter N.

Underſtand the like in any Caſe, let the Declination be what it will, and in any other Latitude.

Example 4. Admit in Latitude 38 deg. 20m. North, and Declination 19d. 50m. South: The Sun riſeth upon the ESE. Point of the Compaſs; I demand the Variation?

In the Table for Latitude 38 deg. and againſt 19 deg. 41 min. (the neareſt to the given Declination) is E S.E. a Quarter S. which ſheweth that there is a Quarter of a Point Variation. For the E.S.E. Point is E.S.E. a Quarter S. and the North Point is N. a Quarter E. For, if you bring ESE. a Quarter S. on the outward Circle of the *Rectifier* right againſt E.S.E. on the inward Circle, then S.S.W. on the Compaſs is SSW. a Quarter W. and SE. is SE. a Quarter S. and E. is E. a Quarter S. And ſo for any other Point, Half point, or Quarter point, by caſting your Eye upon the *Rectifier*.

Note, Theſe Tables ſhew the true Points of Riſing and Setting, and the outward Circle on the *Rectifier* doth the ſame; but the Compaſs, when it differeth from the Tables, ſhews a falſe Point; and the inward Circle on the *Rectifier* doth the ſame as before taught.

Example 5. Admit in Latitude 47d. 24m. North, the Declination 15d. 2m. South, the Sun's riſing E. by S. by the Compaſs; I demand the Variation.

By the Tables the Sun ſhould riſe ESE. therefore there is one Point Variation: For if you bring ESE. on the outward Circle of the *Rectifier*, over againſt the E. by S. in the inward Circle, then the N. by W. on the Compaſs is the true North point; the NW. is the NW. by N. and the S. by E. is the true South Point.

By this Time I ſuppoſe the Reader able to diſcover how much the Variation is, and how to reckon it without any Geometric Demonſtration, or Arithmetic Calculation.

Note, If you have any odd minutes of Latitude, go to that Table neareſt the Latitude you are in.

I come now to reſolve a Queſtion which ſome are puzzled with; and that is this:

Queſt. If the Sun riſe at ENE. by any Compaſs in any Latitude, ſhould not he ſet the ſame Day at WNW. by the ſame Compaſs, and in the ſame Latitude?

Anſwer. If there be no Variation he will; but if there be Variation, he will not. The Reaſon is evident by the *Rectifier*.

By theſe Tables you may know upon what Point of the Compaſs any of the Stars riſe and ſet in any Latitude the Tables contain, either North or South, if the Declination doth not exceed the Sun's greateſt Declination.

Example 6. Let it be required to find the Points of the Compaſs the *Bull's Eye* riſes and ſets upon, in the Latitude of 50 Degrees North.

The Declination of this Star is 16 Deg. North; in the Table that belongs to 50d. againſt 16 Deg. North Declination, the true Point of Riſing is E.N.E. a Quarter N. and the true Point of Setting W.N.W. a Quarter N.

Underſtand the like for any other Star, whoſe Declination doth not exceed the Sun's greateſt Declination.

But, the Point of the Compaſs upon which the Sun or Star riſes and ſets, is affected by the horizontal Refraction, which, as before obſerved, is about 33 Minutes, or a little more than the Sun's Diameter; therefore the Sun is on that Point of the Compaſs, to which theſe Tables are calculated, when the lower Limb is about it's ſemi-diameter, or 16½ Minutes above the Horizon, at which Inſtant the Centre of the Sun ought to be ſet to find the true Variation.

The little Addition to the Tables of Sun-Dials, noticed in Page 97, will alſo here be of great Uſe, in determining the true Point of the Compaſs on which the Sun riſes and ſets.

Suppoſe in Example 5, I wiſh to know how long the Sun's upper Limb (on account of the horizontal Refraction) muſt have been riſen before the Centre is on that Point of the Horizon to which theſe Tables are calculated :

Look in the Tables of Sun-Dials for Latitude 47 Degrees, and you will find before SOUTH DECLINATION 5 m. when the Sun's Declination is nothing, and 6 m. when the Declination is greateſt ; therefore the Time to ſet the Sun with the Compaſs, is about 5½ Minutes after the upper Limb is riſen, or the ſame Time before it ſets. This ought to be particularly attended to in high Latitudes, to determine the true Amplitude of the Sun or Stars.

The Uſe of the RECTIFIER.

THIS Inſtrument, as before deſcribed, containeth two Circles, or Compaſſes, one within the other ; but as it is made of Wood, the one moves upon the other, and by it the Compaſs, when it varies, may be rectified as follows:

Bring the true Point of Riſing or Setting (as the Table ſheweth) to the outward or under Compaſs, right againſt the falſe Point of Riſing or Setting (as your Compaſs ſheweth) on the inward or upper Compaſs ; then will the under Compaſs rectify the upper.

Example 7. Admit in Latitude 45d. N. the Sun's Declination being 7d. 56m. South, the Sun ſetting upon the W. by N. Point of the Compaſs, I demand the Variation ?

The Sun, if there be no Variation, will ſet at W. by S. and riſe at E. by S. as appears from the Table ; therefore it is plain that there are two Points Variation.

Bring the W. by S. Point on the S.ward Compaſs, right againſt the W. by N. Point on the inward Compaſs ; then the Points upon the outward Compaſs explain the Points that are upon the inward ; ſo that according to the foregoing Obſervation, the N.N.E. Point on the Compaſs is the true North : The North is the true N.N.W. the W. by N. is the true W. by S. the S.E. by E. is the true E. by S. And ſo for any other Point of the Compaſs, by only looking on the *Rectifier*.

And thus you may rectify the Compaſs, without reckoning which Way the Variation is, either Eaſtward or Weſtward : The *Rectifier* doing it ſo plain, that you can't be miſtaken.

A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either —— North or South.

The Degrees of Latitude.

Degrees of Declination.

Sun's Decli.	1		2		3		4		5		6	
	D	M	D	M	D	M	D	M	D	M	D	M
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	1	0	1	0	1	0	1	0	1	0
2	2	0	2	0	2	0	2	0	2	0	2	0
3	3	0	3	0	3	0	3	0	3	0	3	1
4	4	0	4	0	4	0	4	0	4	1	4	1
5	5	0	5	0	5	0	5	1	5	1	5	1
6	6	0	6	0	6	0	6	1	6	1	6	1
7	7	0	7	0	7	1	7	1	7	2	7	2
8	8	0	8	0	8	1	8	1	8	2	8	2
9	9	0	9	0	9	1	9	1	9	2	9	2
10	10	0	10	0	10	1	10	1	10	2	10	3
11	11	0	11	0	11	1	11	1	11	3	11	3
12	12	0	12	0	12	1	12	1	12	3	12	4
13	13	0	13	0	13	1	13	2	13	3	13	4
14	14	0	14	0	14	1	14	2	14	3	14	4
15	15	0	15	0	15	1	15	2	15	4	15	5
16	16	0	16	1	16	1	16	2	16	4	16	5
17	17	0	17	1	17	1	17	2	17	4	17	5
18	18	0	18	1	18	1	18	2	18	4	18	6
19	19	0	19	1	19	1	19	3	19	4	19	6
20	20	0	20	1	20	2	20	3	20	5	20	7
21	21	0	21	1	21	2	21	3	21	5	21	7
22	22	0	22	1	22	2	22	3	22	5	22	7
23	23	0	23	1	23	2	23	3	23	5	23	8
23.29	23	29	23	30	23	31	23	33	23	35	23	38

A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either —— North or South.

The Degrees of Latitude.

Sun's Decli. Degrees of Declination.	7 D	7 M	8 D	8 M	9 D	9 M	10 D	10 M	11 D	11 M	12 D	12 M
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	0	1	0	1	0	1	1	1	1	1	1
2	2	1	2	1	2	1	2	2	2	2	2	3
3	3	1	3	2	3	2	3	3	3	3	3	4
4	4	2	4	3	4	3	4	4	4	4	4	5
5	5	2	5	3	5	3	5	5	5	5	5	7
6	6	2	6	3	6	4	6	6	6	7	6	8
7	7	3	7	4	7	5	7	7	7	8	7	9
8	8	3	8	4	8	6	8	8	8	9	8	11
9	9	4	9	5	9	7	9	9	9	10	9	12
10	10	4	10	5	10	7	10	10	10	11	10	13
11	11	5	11	6	11	8	11	11	11	12	11	15
12	12	5	12	7	12	9	12	12	12	13	12	16
13	13	6	13	8	13	10	13	13	13	15	13	18
14	14	6	14	9	14	10	14	14	14	16	14	19
15	15	7	15	9	15	11	15	15	15	17	15	20
16	16	7	16	9	16	12	16	16	16	18	16	22
17	17	8	17	10	17	13	17	17	17	20	17	23
18	18	8	18	11	18	14	18	18	18	21	18	25
19	19	9	19	11	19	15	19	19	19	22	19	26
20	20	9	20	12	20	16	20	20	20	24	20	28
21	21	10	21	13	21	17	21	21	21	25	21	29
22	22	10	22	13	22	17	22	22	22	26	22	31
23	23	11	23	14	23	18	23	23	23	28	23	33
23.29	23	40	23	44	23	49	23	54	23	57	24	2

A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either —— North or South.

The Degrees of Latitude.

Sun's Decli. Degrees of Declination.	13		14		15		16		17		18	
	D	M	D	M	D	M	D	M	D	M	D	M
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	2	1	2	1	2	1	2	1	2	1	3
2	2	3	2	3	2	4	2	5	2	5	2	6
3	3	5	3	5	3	6	3	7	3	8	3	9
4	4	6	4	7	4	8	4	10	4	11	4	12
5	5	8	5	9	5	11	5	12	5	13	5	15
6	6	10	6	11	6	13	6	15	6	16	6	19
7	7	11	7	13	7	15	7	17	7	19	7	22
8	8	12	8	15	8	17	8	19	8	22	8	25
9	9	14	9	17	9	19	9	22	9	25	9	28
10	10	15	10	18	10	21	10	24	10	27	10	30
11	11	17	11	20	11	23	11	27	11	30	11	34
12	12	19	12	22	12	25	12	29	12	33	12	38
13	13	21	13	24	13	28	13	32	13	36	13	41
14	14	22	14	26	14	30	14	34	14	39	14	44
15	15	24	15	28	15	32	15	37	15	42	15	47
16	16	26	16	30	16	35	16	40	16	45	16	51
17	17	28	17	32	17	37	17	42	17	48	17	54
18	18	30	18	34	18	40	18	45	18	51	18	57
19	19	31	19	36	19	42	19	48	19	54	20	1
20	20	33	20	38	20	44	20	51	20	57	21	5
21	21	35	21	41	21	46	21	53	22	0	22	8
22	22	37	22	43	22	49	22	56	23	4	23	12
23	23	38	23	45	23	51	23	59	24	7	24	15
23.29	24	8	24	15	24	22	24	20	24	38	24	46

A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either —— North or South.

The Degrees of Latitude.

Sun's Decli. Degrees of Declination.	19		20		21		22		23		24	
	D	M	D	M	D	M	D	M	D	M	D	M
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	3	1	4	1	4	1	4	1	5	1	5
2	2	7	2	8	2	8	2	9	2	10	2	11
3	3	10	3	12	3	13	3	14	3	15	3	17
4	4	13	4	15	4	17	4	19	4	21	4	23
5	5	17	5	19	5	21	5	23	5	26	5	28
6	6	21	6	23	6	26	6	28	6	31	6	34
7	7	24	7	27	7	30	7	33	7	37	7	40
8	8	28	8	31	8	34	8	38	8	42	8	45
9	9	31	9	35	9	39	9	43	9	47	9	51
10	10	34	10	38	10	43	10	47	10	52	10	57
11	11	38	11	43	11	48	11	52	11	58	12	3
12	12	42	12	47	12	52	12	57	13	3	13	10
13	13	47	13	52	13	58	14	4	14	10	14	17
14	14	50	14	55	15	1	15	7	15	14	15	21
15	15	53	16	0	16	5	16	12	16	19	16	27
16	16	57	17	3	17	10	17	18	17	25	17	34
17	18	1	18	7	18	15	18	23	18	31	18	40
18	19	5	19	11	19	20	19	28	19	37	19	46
19	20	8	20	16	20	24	20	33	20	43	20	52
20	21	12	21	20	21	29	21	9	21	39	21	59
21	22	16	22	25	22	34	22	44	22	55	23	6
22	23	20	23	29	23	39	23	50	24	1	24	12
23	24	24	24	34	24	44	24	55	25	7	25	19
23.29	24	56	25	5	25	16	25	27	25	39	25	51

A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either North or South.

The Degrees of Latitude.

Sun's Decli. Degrees of Declination.	25		26		27		28		29		30	
	D	M	D	M	D	M	D	M	D	M	D	M
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	6	1	7	1	7	1	8	1	8	1	9
2	2	12	2	13	2	14	2	16	2	17	2	19
3	3	18	3	20	3	22	3	24	3	25	3	28
4	4	25	4	27	4	29	4	32	4	34	4	37
5	5	31	5	33	5	36	5	40	5	43	5	46
6	6	37	6	41	6	44	6	48	6	52	6	56
7	7	43	7	48	7	51	7	56	8	0	8	5
8	8	5[illegible]	8	54	8	59	9	4	9	9	9	15
9	9	56	10	1	10	6	10	12	10	18	10	24
10	11	2	11	7	11	14	11	20	11	26	11	33
11	12	9	12	15	12	22	12	29	12	36	12	43
12	13	16	13	23	13	29	13	37	13	45	13	3
13	14	23	14	31	14	38	14	46	14	54	15	3
14	15	2[illegible]	15	37	15	45	15	54	16	3	16	13
15	16	35	16	44	16	53	17	3	17	12	17	23
16	17	42	17	51	18	1	18	11	18	22	18	33
17	18	49	18	59	19	9	19	20	19	31	19	43
18	19	56	20	6	20	17	20	29	20	41	20	54
19	21	3	21	14	21	26	21	38	21	51	22	5
20	22	10	22	22	22	31	22	48	23	1	23	16
21	23	18	23	30	23	43	23	57	24	11	24	27
22	24	24	24	38	24	51	25	6	25	22	25	38
23	25	32	25	46	26	0	26	16	26	32	26	49
23.29	26	5	26	19	26	34	26	49	27	6	27	23

A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either —— North or South.

The Degrees of Latitude.

Degrees of Declination.	31		32		33		34		35		36	
Sun's Decli.	D	M	D	M	D	M	D	M	D	M	D	M
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	10	1	10	1	11	1	12	1	13	1	14
2	2	20	2	21	2	23	2	25	2	27	2	28
3	3	30	3	33	3	35	3	37	3	40	3	43
4	4	40	4	43	4	46	4	50	4	53	4	57
5	5	50	5	54	5	58	6	2	6	6	6	11
6	7	0	7	4	7	10	7	15	7	20	7	25
7	8	10	8	16	8	21	8	27	8	33	8	39
8	9	21	9	27	9	33	9	39	9	47	9	54
9	10	31	10	37	10	45	10	52	11	0	11	9
10	11	41	11	48	11	56	12	4	12	13	12	23
11	12	52	13	0	13	9	13	18	13	28	13	38
12	14	2	14	11	14	21	14	31	14	42	14	53
13	15	13	15	23	15	33	15	44	15	56	16	9
14	16	23	16	34	16	45	16	57	17	11	17	24
15	17	34	17	46	17	58	18	11	18	25	18	39
16	18	45	18	57	19	11	19	24	19	39	19	55
17	19	56	20	10	20	24	20	39	20	54	21	11
18	21	8	21	22	21	36	21	53	22	10	22	27
19	22	19	22	34	22	50	23	7	23	25	23	43
20	23	31	23	47	24	4	24	21	24	40	25	0
21	24	43	25	0	25	18	25	36	25	56	26	18
22	25	55	26	13	26	32	26	51	27	13	27	35
23	27	7	27	26	27	46	28	7	28	29	28	53
23.29	27	42	28	1	28	22	28	44	29	6	29	34

A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either ——— North or South.

The Degrees of Latitude.

Sun's Decli.	37		38		39		40		41		42	
	D	M	D	M	D	M	D	M	D	M	D	M
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	15	1	16	1	17	1	18	1	19	1	21
2	2	30	2	32	2	34	2	36	2	39	2	41
3	3	45	3	48	3	51	3	55	3	58	4	2
4	5	0	5	5	5	8	5	13	5	18	5	23
5	6	15	6	21	6	26	6	32	6	38	6	44
6	7	31	7	37	7	43	7	50	7	57	8	5
7	8	46	8	54	9	1	9	9	9	17	9	26
8	10	2	10	11	10	19	10	28	10	37	10	47
9	11	17	11	27	11	37	11	47	11	57	12	9
10	12	32	12	43	12	54	13	5	13	18	13	31
11	13	49	14	10	14	12	14	25	14	39	14	53
12	15	5	15	18	15	38	15	45	16	0	16	15
13	16	21	16	35	16	49	17	5	17	20	17	37
14	17	38	17	53	18	8	18	24	18	42	19	0
15	18	54	19	10	19	27	19	44	20	4	20	23
16	20	11	20	28	20	46	21	5	21	25	21	46
17	21	28	21	46	22	6	22	26	22	47	23	10
18	22	46	23	5	23	26	23	47	24	10	24	34
19	24	3	24	24	24	46	25	9	25	33	25	58
20	25	21	25	43	26	6	26	31	26	56	27	24
21	26	39	27	3	27	27	27	53	28	21	28	50
22	27	58	28	23	28	49	29	16	29	45	30	16
23	29	17	29	43	29	11	30	40	31	11	31	43
23.29	29	56	30	22	30	50	31	20	31	52	32	28

Degrees of Declination.

A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either —— North or South.

The Degrees of Latitude.

	Sun's Decl.	43		44		45		46		47		48	
		D	M	D	M	D	M	D	M	D	M	D	M
Degrees of Declination.	0	0	0	0	0	0	0	0	0	0	0	0	0
	1	1	22	1	23	1	25	1	26	1	28	1	29
	2	2	44	2	47	2	50	2	53	2	56	2	59
	3	4	6	4	10	4	15	4	19	4	24	4	29
	4	5	28	5	34	5	40	5	46	5	52	5	59
	5	6	51	6	58	7	5	7	12	7	20	7	29
	6	8	13	8	21	8	30	8	39	8	49	8	59
	7	9	35	9	45	9	56	10	6	10	18	10	30
	8	10	58	11	9	11	21	11	34	11	47	12	0
	9	12	21	12	34	12	47	13	1	13	16	13	31
	10	13	44	13	58	14	13	14	28	14	44	15	2
	11	15	7	15	22	15	38	15	56	16	15	16	34
	12	16	31	16	48	17	6	17	25	17	44	18	6
	13	17	55	18	13	18	33	18	54	19	16	19	39
	14	19	19	19	39	20	0	20	23	20	47	21	12
	15	20	43	21	5	21	28	21	52	22	18	22	45
	16	22	8	22	32	22	56	23	23	23	50	24	40
	17	23	34	23	59	24	25	24	53	25	23	25	55
	18	24	59	25	26	25	54	26	25	26	57	27	31
	19	26	25	26	54	27	25	27	58	28	32	29	7
	20	27	53	28	23	28	56	29	31	30	7	30	45
	21	29	20	30	53	30	27	31	3	31	42	32	23
	22	30	48	31	22	31	58	32	37	33	18	34	3
	23	32	16	32	51	33	30	34	12	34	56	35	43
	23.29	33	3	33	40	34	20	35	3	35	48	36	35

A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either —— North or South.

The Degrees of Latitude.

Sun's Decl.	49		50		51		52		53		54	
	D	M	D	M	D	M	D	M	D	M	D	M
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	31	1	33	1	35	1	37	1	39	1	42
2	3	3	3	6	3	10	3	15	3	20	3	24
3	4	34	4	40	4	46	4	52	4	59	5	6
4	6	6	6	14	6	22	6	30	6	39	6	49
5	7	38	7	48	7	58	8	8	8	19	8	31
6	9	10	9	21	9	33	9	46	10	0	10	15
7	10	42	10	55	11	9	11	24	11	40	11	57
8	12	14	12	29	12	45	13	2	13	21	13	41
9	13	47	14	5	14	24	14	43	15	4	15	26
10	15	21	15	40	16	1	16	23	16	46	17	11
11	16	54	17	16	17	39	18	3	18	29	18	57
12	18	28	18	52	19	18	19	44	20	12	20	43
13	20	3	20	29	20	57	21	26	21	57	22	30
14	21	38	22	6	22	37	23	8	23	42	24	18
15	23	14	23	45	24	18	24	52	25	28	26	7
16	24	51	25	24	25	59	26	36	27	16	27	58
17	26	28	27	3	27	41	28	21	29	4	29	50
18	28	6	28	43	29	24	30	7	30	53	31	42
19	29	45	30	25	31	8	31	55	32	45	33	38
20	31	25	32	8	32	54	33	44	34	39	35	35
21	33	6	33	52	34	41	35	34	36	31	37	32
22	34	48	35	37	36	30	37	27	38	29	39	26
23	36	33	37	26	38	23	39	24	40	29	41	40
23.29	37	26	38	20	39	19	40	23	41	29	42	46

Degrees of Declination.

A TABLE of Amplitudes, fitting all Places from the Equator, to 60 Degrees of Latitude, either North or South.

The Degrees of Latitude.

Sun's Decl.	55		56		57		58		59		60	
Degrees of Declination.	D	M	D	M	D	M	D	M	D	M	D	M
0	0	0	0	0	0	0	0	0	0	0	0	0
1	1	45	1	47	1	50	1	53	1	56	2	0
2	3	29	3	34	3	40	3	46	3	53	4	0
3	5	14	5	22	5	31	5	40	5	50	6	0
4	6	59	7	10	7	22	7	34	7	47	8	1
5	8	45	8	57	9	11	9	26	9	43	10	2
6	10	30	10	47	11	4	11	22	11	42	12	4
7	12	15	12	35	12	56	13	18	13	41	14	6
8	14	2	14	25	14	48	15	14	15	41	16	10
9	15	49	16	14	16	45	17	10	17	41	18	14
10	17	37	18	5	18	33	19	7	19	41	20	18
11	19	26	19	56	20	29	21	4	21	43	22	26
12	21	15	21	49	22	25	23	4	23	47	24	34
13	23	5	23	43	24	23	25	7	25	54	26	44
14	24	56	25	37	26	21	27	9	28	1	28	55
15	26	49	27	34	28	22	29	14	30	12	31	9
16	28	43	29	32	30	24	31	21	32	22	33	27
17	30	39	31	31	32	27	33	28	34	32	35	47
18	32	35	33	33	34	34	35	40	36	53	38	9
19	34	35	35	36	36	46	37	54	39	13	40	36
20	36	36	37	42	38	53	40	12	41	37	43	10
21	38	39	39	51	41	9	42	34	44	7	45	48
22	40	47	42	4	43	27	44	59	46	40	48	32
23	42	56	44	19	45	50	47	30	49	21	51	23
23.29	44	0	45	27	47	2	48	46	50	47	52	51

The Uſe of the Tables of Amplitudes.

THE Sun or Star's Amplitude is the Diſtance of the Riſing or Setting of the Sun or Star from the Eaſt or Weſt Point of the Horizon, in Degrees and Minutes, reckoned in the Horizon; either Northerly or Southerly, making Allowance for the horizontal Refraction, as mentioned after the Deſcription of the aſtronomic Tables.

Note, When the Sun or Stars have North Declination, they riſe to the Northward of the Eaſt and ſet to the Northward of the Weſt: But if their Declination be South, they riſe to the Southward of the Eaſt, and ſet to the Southward of the Weſt: And by theſe Tables the Amplitude is thus found, *viz.*

Look the Latitude in the Head of the Tables, the Declination in the firſt Column on the Left-Hand; and in the common Angle of Meeting is the Amplitude required.

Example 1. In the Latitude of 30 deg. the Sun's Declination being 7d. 0m. North, I demand the Amplitude?

Anſw. The Amplitude is 8 deg. 6 min. For under Latitude 30d. in Page 140, and againſt Declination 7d. you will find 8d. 6m. which is the Amplitude from the Eaſt, Northward at Sun-riſing, and from the Weſt, Northward at Sun-ſetting. But if the Declination had been 7d. 0m. South, in Latitude 30d. as aforeſaid, then the Amplitude would have been 8d. 6m. from the Eaſt, Southward at Sun-riſing, and 8d. 6m. from the Weſt, Southward at Sun-ſetting.

If there be any odd Minutes of Declination, take the Proportional Parts.

Example 2. In the Latitude of 42d. 30m. the Sun's Declination being 12d. 15m. I demand the Amplitude?

Anſw. The Ampl. is 16d. 43m. found as follows: According to the former Directions, for the Lat. of 42d.

and Decl'n. being $\left\{\begin{matrix}12\\13\end{matrix}\right\}$ d. the Ampl. is $\left\{\begin{matrix}16\text{d. } 15\text{m.}\\17\text{d. } 37\text{m.}\end{matrix}\right.$

Subtract, and their Difference is ———————— 1d. 22m.

Then ſay, as 1d. or 60m. is to 1d. 22m. or 82m. ſo is 15m. to 20m. found as hereunder :

If 60m. give ——— 82m. what ſhall 15m. ?

15

410

82

6|0)123|0(20m. Proportional Parts.

30 Remainder

Lat. 42d. and Declin. 12d. the Amplit. is 16d. : 15m.
To it add the Proportional Parts above —— 0d. : 20m.
Gives Amplitude for Declin. 12d 15m. to be 16d. : 35m.

Again, for Lat. 43d. { 12 } deg. Ampl. { 16d. : 31m.
and Declin. being — { 13 } —is— { 17d. : 55m.
Subtracted give the Difference to be ——— 1d. : 24m.

Then ſay, As 60m. is to 1d. 24m. or 84m. ſo is 15m. to 21m. found as hereunder :

If 60m. give ——— 84m. what ſhall 15m. ?

15

420

84

6|0)126|0(21 min. Proportional Part.

6

0 Remainder.

	D.	M.
Lat. 43d. and Declin. 12d. Amplitude is ———	16	31
To it add the Proportional Parts above ———	0	21
Gives for Declination 12d. 15m. the Amplitude —	16	52

Now becauſe the given Latitude 42d. 30m. is in the middle between 42d. and 43d. therefore the Mean of the Amplitudes before found, is the Amplitude required : thus,

Lat. { 42 } d. Decl. 12d. 15m. the Ampl. is { 16d. : 35m.
{ 43 } { 16d : 52m.
Added together, is ——— 33d. : 27m.

The half is the Amplitude required——16d. : 43m. Thus may the Amplitude be found for any odd Minutes of Latitude or Declination, though the Table is calculated for whole Degrees only, but this is ſeldom neceſſary.

By this Table the Variation of the Compaſs is moſt readily found; for, by the Azimuth or Amplitude Compaſs find the Sun or Star's Magnetic Amplitude, at their Riſing or Setting; and their true Amplitude, to the Latitude of the Place, and their Declination, by this Table; the Difference of theſe Amplitudes (when both are North or both South,) but their Sum (if one be North the other South) is the Variation of the Compaſs.

But by the *Rectifier* it is moſt eaſily done thus:

Bring the Magnetic Amplitude, on the upper or innermoſt Compaſs, right againſt the true Amplitude, on the lower or outermoſt Compaſs, then doth the North Point in the upper ſtand againſt the Variation in the lower; and the upper Compaſs is explained in all its Parts by the lower Compaſs.

Example 1. Suppoſe the Magnetic Amplitude at Sunriſing, found by the Azimuth or Amplitude Compaſs, be Eaſt Southerly, 15d. 30m. and the true Amplitude, according to the Latitude of the Place, and the Declination of the Object obſerved, be Eaſt Southerly 26d. 45m. I demand the Variation of the Compaſs?

By the *Rectifier.*

Bring 15d. 30m. Eaſt Southerly on the upper Compaſs, againſt 26d. 45m. Eaſt Southerly on the lower Compaſs. Then doth the North Point on the firſt ſtand right againſt 11d. 15m. North, Eaſterly on the latter ſo that the Compaſs doth vary 11d. 15m. or one Point Eaſt.

Ex. 2.	True	Ampl.	7d. 0m. Eaſt, Northerly.
	Magn.		15d. 30m. Eaſt, Southerly.

Demand the Variation of the Compaſs?

By the Rectifier.

Bring 15d. 30m. Eaſt, Southerly on the upper Compaſs, right againſt 7 deg. Eaſt, Northerly on the lower Compaſs, then the North Point on the firſt ſtands againſt 22 deg. 30 min. on the latter, North, Weſterly, that is two Points Weſt Variation. In like Manner for any other; and thus the Variation is moſt readily found. This *RECTIFIER* may be made of Wood, Braſs, &c.

In North Latitude the Sun or a Star having North Declination; or in South Latitude, having South Declination, to find their Altitudes when due Eaſt or Weſt by the Tables of Amplitudes.

Take the Complement of the Latitude, that is, what it wants of 90 Degrees. Then with the Complement (inſtead of the Latitude) and the Declination, find the Amplitude, which will be the Degrees and Minutes of the Sun's Altitude when due Eaſt or Weſt.

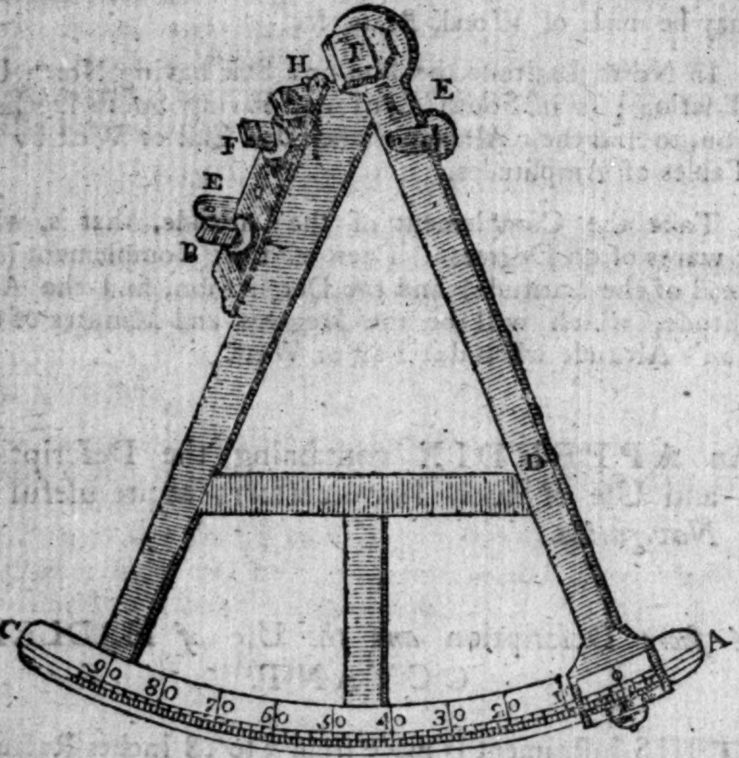
An APPENDIX containing the Deſcription and Uſe of ſuch INSTRUMENTS as are uſeful in *Navigation.*

A ſhort Deſcription *and the* Uſe *of* HADLEY's OCTANT.

THIS Inſtrument is made from 3 to 18 Inches Radius: The Parts of which are,

The Index D.
The Index-Glaſs I.
The Horizon-Glaſſes B. F.
The Screens H.H.

The ſight vanes EE. and the graduated arch AC, which contains only the eighth part of the circumference of a circle, or 45 degrees, divided into 90 primary diviſions, which, by the laws of Catoptrics, anſwer to degrees; which are numbered 0. 10. 20, &c. to 90. Each degree is divided into 3 parts of 20 minutes each, which, by the help of the Nonius, or Vernier's ſcale, are ſubdivided into minutes of a degree.



The INDEX D.

Is a flat rod or bar, moveable on the centre of the inſtrument, and that part of the index, which ſlides over the graduated arch AC. is open in the middle to ſee the diviſions, which are cut by the Nonius; by the help of which an angle or altitude may be meaſured to a minute. On the bottom of the index, againſt the back of the arch, there is a ſcrew to keep the index faſt when required.

The INDEX-GLASS I

Is a piece of glaſs, truly ground, ſilvered on the back, and ſet in a braſs frame. The uſe of this glaſs is to receive the rays coming from an object, and to reflect them to the horizon glaſſes. Behind this glaſs are ſcrews to ſet it perpendicular to the plane of the inſtrument.

The HORIZON-GLASSES B,F

Are ſmaller pieces of ground glaſs, one part of which is ſilvered (the other part left tranſparent to view an object direct) ſet in frames, and placed on the limb at B and F, to receive the rays of an object reflected from the index-glaſs, and to reflect it again to the eye, looking through the holes in the ſight vanes. Both theſe glaſſes are mounted on adjuſting plates with ſcrews; by which the glaſſes may be adjuſted when neceſſary. F is uſed for a fore-obſervation, and B for the back-obſervation.

The SCREENS HH,

Are pieces of coloured glaſs, ground and ſet in frames; their uſe is to take off the glare of the ſun's rays, when too ſtrong for the eye.

The SIGHT VANES E,E

Are two pieces of braſs ſtanding perpendicular to the plane of the inſtrument; the vane for the fore-obſervation has two ſmall holes in it: the inner one for more readily viewing the reflected image of ſtars, or faint objects, on the edge of the ſilvered part of the horizon-glaſs; the other for viewing the image of the ſun, when bright, from the poliſhed ſurface of the unſilvered part.

The Nonius, or Vernier, is a ſmall piece of ſloping, or feather-edged ivory, braſs or box-wood, graduated and faſtened to the bottom of the opening of the index; but often the lower part of the opening is graduated for the Nonius, which is numbered thus, 10—15—0—5—10; or thus, 10—15—Δ—5—10; ſometimes thus, 20—15—10—5—0, and ſlides upon the graduations of the arch.

The arch, as before obſerved, is divided into 90 degrees, numbered 10, 20, 30, &c. and each degree into 3 parts of 20 minutes each, and is to be read thus, 1d.—1d. 20m.—1d. 40m.—2d.—2d. 20m.—2d. 40m.—3d.&c.obſerving to read to the diviſion that the 0, or diamond-like point, of the Nonius laſt paſſed over; then the Nonius will give the number of minutes more, to be added to the diviſion laſt paſſed by the Nonius. Thus, ſuppoſe the 0, or △ of the Nonius has paſſed over 12 degrees and two parts, or 12d. 40m. and ſtands ſomewhere between 12d. 40m. and 13d. then obſerve what diviſion or line on the Nonius coincides with any diviſion or line on the arch, that number on the Nonius will be the minutes to be added to 12d. 40m. Suppoſe 15 on the Nonius touches ſome diviſion on the arch, then 15m. muſt be added to 12d. 40m. and the angle or altitude meaſured will be 12d. 55m.

N. B. No two lines on the Nonius, except the two tens, can exactly coincide with the lines on the graduated arch, if the inſtrument be well divided.

The principles of this excellent inſtrument are ſo well known, and have been ſo thoroughly inveſtigated by many able Geometers, that, here, a demonſtration is unneceſſary; I ſhall therefore proceed to the ſeveral neceſſary adjuſtments which this quadrant (as it is called) may require, not from any intricacy or imperfection in the inſtrument, but from the very great exactneſs with which an angle may be meaſured by it when nicely adjuſted.

This inſtrument, though it come perfectly adjuſted from the maker's hands, which is not always the caſe, is liable to be put out of order by many accidents, ſuch as lying in the ſun, the ſpray of ſea cauſing it to warp, or the expanding and contracting the frame; ſometimes a fall, &c. It is therefore neceſſary, that the mariner ſhould be able to verify and re-adjuſt the ſeveral parts of his inſtrument at Sea.

Firſt, the index-glaſs muſt be perpendicular to the plane of the quadrant, which, if not, will be eaſily diſcovered by the following method: Hold the plane of the quadrant in an horizontal poſition, with the index-glaſs near the eye; look right down the quadrant, in ſuch a manner as to ſee the arch of the quadrant direct, and at the ſame time reflected, by the index-glaſs, then if the reflected image, and the arch ſeen direct, make as it were but one plane, the glaſs is perpendicular to the plane of the inſtrument; on the contrary, if the arch and its reflected image do not appear to make one continued right plane, it ſhews the index-glaſs muſt have an inclination, and this muſt be rectified by the adjuſting ſcrews behind the frame of the index-glaſs. It is eaſy to diſcover which way the inclination is, by preſſing the index-glaſs with your thumb while you obſerve the arch.

Secondly, the axes of the horizon-glaſſes muſt be parallel to the axis of the index-glaſs, if not, the error is eaſily diſcovered and rectified in the fore horizon-glaſs, when the index-glaſs is adjuſted. Thus, bring o on the Nonius nearly to o on the graduated arch, and look directly through the ſight vane at the moon, or any bright ſtar, ſo as to ſee the reflected image in the horizon-glaſs, and the object, at the ſame time, through the unſilvered part; then move the index backwards and forwards ſlowly, and obſerve if the image and the object paſs directly over each other, if they do, the axis are parallel; but if one paſs to the right, and the other to the left, then put your thumb upon the horizon-glaſs, and preſs it a little, looking ſtill at the object, and you will immediately ſee which way it wants to be adjuſted, and may adjuſt it accordingly by the ſcrews on the adjuſting plate. This is a nice though very neceſſary adjuſtment, and requires care and patience; for a ſmall turn of the ſcrews will cauſe a conſiderable variation in the axis.

I would adviſe the mariner to have a ſmall piece of coloured glaſs, ſet in braſs, to ſlide over the ſight vane occaſionally, to guard the eye, and then this verification may be commodiouſly made by the ſun as well as the moon or ſtar; for the ſcrews muſt be turned back, that the object and reflected image may be ſeen nearly equally diſtinct.

Thirdly, The index error. This adjuſtment is wel known by thoſe who uſe this inſtrument. The common mode of performing it is thus, bring 0 on the Nonius exactly to 0 on the arch, then looking directly through the ſight vane at the horizon; if the reflected horizon, in the horizon-glaſs, appear either higher or lower than the horizon ſeen directly through the unſilvered part; then, by means of the braſs lever fixed at the back of the inſtrument to the horizon-glaſs, bring both the reflected and direct horizon to appear as but one line. Theſe three adjuſtments being made, the inſtrument is completely rectified or adjuſted for any obſervation.

The index error may be more accurately determined thus: ſlide on the coloured glaſs before mentioned upon the ſight vane, put the ſcreens back, and meaſure the diameter of the ſun, that is, bring the upper limb to coincide with the lower, if it meaſure 32 minutes * there is little or no index error; but if it meaſure leſs, add the difference to any angle you meaſure, if more, ſubtract the difference from any angle you meaſure, the ſum, or difference reſpectively, will be the true angle or altitude.

EXAMPLE.

Suppoſe the ſun's diameter meaſures 28 minutes, and the altitude taken by the inſtrument be 34d. 10m. then add the error 4m. (the difference between 32m. and 28m.) the altitude will be 34d. 14m. but had the diameter meaſured 36m. then the difference 4m. muſt have been ſubtracted, and the altitude would be 34d. 6m.

To take an Altitude of the Sun by the fore Obſervation.

The ſun is generally bright enough to be ſeen by reflection from the poliſhed ſurface of the unſilvered part of the horizon-glaſs: therefore look through the outer hole in the ſight vane, having put one of the ſcreens down in its place to guard the eye. Hold the inſtrument vertical, and turning yourſelf towards the ſun, direct the ſight to that part of the horizon which is under the ſun; then move the index forwards 'till you ſee the red image of the ſun come down towards the horizon. If you meet with any difficulty in finding the red image of the ſun turn the ſcreen back, and the ſun's image will be ſo bright you cannot miſs it; and you may then put the ſcreen in its proper place again. Having brought the image down near to the horizon, ſwing the octant backwards and forwards, making your eye the centre of motion, moving the index forward at the ſame time, 'till the lower limb of the ſun juſt ſweeps the horizon, and you will have the apparent altitude of the ſun's lower limb upon the arch of the quadrant at that inſtant. But the meridian, or greateſt altitude, is that, from which the latitude is to be determined, which is exactly at noon or 12 o'clock. Now if you have ſet your watch, as directed in the uſe of the tables of dials, and you have not ſailed conſiderably to the Eaſtward or Weſtward, you may know exactly when to take the meridian altitude. But ſuppoſing you have ſailed a degree directly Eaſt or Weſt, it will make but 4 minutes difference between your watch and the ſun, and much time may be ſaved in waiting to obſerve the greateſt altitude; beſides your inſtrument will not lie ſo long roaſting and warping in the ſun upon the hen-coop, or on the drum head of the capſtan, as is too commonly the caſe. Having found the apparent altitude of the ſun's lower limb, the following corrections muſt be applied.

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* The ſun's diameter in January is about 32 minutes and half, in July about 31 minutes and half, and in April and October 32 minutes nearly.

Firſt. The index error, if any, to be added or ſubtracted, as taught in the third correction of the inſtrument.

Secondly. The dip of the horizon.

Thirdly. The ſun's ſemidiameter.

Theſe three corrections give the apparent altitude of the ſun's centre, to which apply the correction for refraction, and you will have the true altitude of the ſun's centre very nearly, the correction for the ſun's parallax being ſo ſmall, that it may always be neglected.

For an Example, ſee Page 162.

The ſame corrections muſt be made for any ſtar, only here is no ſemidiameter to be allowed.

Of the Back Obſervations.

I know no eaſy practical method, at ſea, to adjuſt the axis of the back horizon-glaſs parallel to the axis of the index-glaſs; therefore, ſuppoſing this to be truly placed by the maker, the following method will ſo far verify and adjuſt it, as to make it extremely uſeful when the fore obſervation cannot be uſed on account of land being in the way, or when a very obſcure horizon for the fore obſervation may make the back obſervation more eligible.

At any time when you have a clear horizon both for the fore and back obſervation, take the altitude of the ſun's lower limb by the fore obſervation, fix the index, ſhift the ſcreens to the back horizon glaſs, turn immediately round and uſe the back ſight vane and horizon glaſs; then if the upper limb of the ſun (in the obſervation it will appear to you to be the lower limb) appear to ſweep the horizon, the back horizon glaſs is true; if not, adjuſt it by its lever. Repeat this ſeveral times when the ſun does not riſe or fall very faſt; thus your inſtrument will be nearly adjuſted, and ready for an obſervation when requiſite.

The back obſervation is managed exactly in the ſame manner as the fore obſervation, only the back muſt be turned towards the ſun, the ſcreens ſhifted to that horizon glaſs, and the ſemidiameter of the ſun muſt be ſubtracted (if the apparent lower limb be taken) and the dip added, to find the apparent altitude of the ſun's centre; from which ſubtract the effect of refraction, and you will have the true altitude nearly.

There is generally a lubber's lump, or ſmall piece of braſs, fixed to ſtop the index where 0 on the Nonius ſhould coincide with 0 on the arch, which is ſeldom placed exact; I would therefore adviſe the mariner to throw it away, and truſt to his own eyes and care in the correction of his in-

inſtrument; beſides if this be taken away, the correction may be very accurately eſtimated by taking the diameer of the ſun, moon, or any object before and behind o on the arch; that is, firſt bring the upper limb of the object to coincide with the lower, and note the angle; then take it on the extra arch as it is called, that is, bring the lower limb to coincide with the upper, and note the angle: Half the difference of theſe two angles will be the true correction of the index error.

EXAMPLE.

Suppoſe the moon's diameter meaſures 35m. on the arch, and 28m. on the extra arch, the difference is 7m. half of which is 3½m. to be ſubtracted for the error, becauſe the diameter meaſures more on the arch, or gives the moon's diameter too much; but had the extra arch given the greater angle, the error would have been additive.

Having given a ſhort, but I hope plain deſcription, &c. of the immediate uſe of the common Hadley's quadrant at ſea, if the reader want further information of the uſe of it and the ſextant, with the ſeveral improvements that have been lately attempted to make them more uſeful a ſea, I muſt beg leave to refer him to the new edition of Atkinſon's Epitome, and Wilſon's Navigation, which now is publiſhed.

To work an Obſervation.

1. IF the Sun or Star hath North Declination, and be on the Meridian to the Southward of you, ſubtract the Declination from the Meridian Altitude; the Remainder is the Height of the Equinoctial or Complement of the Latitude North.

2. But if the Object obſerved hath South Declination, and be to the Southward of your Zenith, add; the Sum (if it exceed not 90 deg.) is the Height of the Equator, or Complement of the Latitude North: If the Sum exceeds 90 deg. ſubſtract 90 from it; the Remainder is the Latitude South.

3. If the Object hath North Declination, and be on the Meridian to the Northward, add the Declination

to the Meridian Altitude ; the Sum if it exceed not 90d. is the Height of the Equator, or Complement of the Latitude South : But if it doth exceed 90 deg. ſubtract 90d. from the ſaid Sum, the Remainder is the Latitude North.

4. If the Sun hath South Declination, and be to the Northward at Noon, ſubtract the Declination from his Meridian Altitude ; the Remainder is the Complement of the Latitude, South.

5. When the Sun hath no Declination, the Meridian Altitude is the Complement of the Latitude North, if he be South at Noon ; and the contrary.

6. If the Sun be in the Zenith, and at the ſame Time he hath no Declination, you are then under the Equinoctial.

7. But if the Sun hath North or South Declination, and in the Zenith, the Declination is the Latitude you are in, North or South.

8. If you obſerve the Sun or any Star upon the Meridian beneath the Pole, add the Meridian Altitude to the Complement of the Sun or Star's Declination ; the Sum is the Height of the Pole, or Latitude of the Place.

Theſe eight Rules are explained by the Examples following.

xamples for working an Obſervation in North Latitude.

Example 1. ADMIT at Sea I obſerve the Sun's Meridian Altitude to 42d. 20m. South, and at the ſame Time the Sun's Declination is 10d. 10m. North. I demand the Latitude I am in ?

	D.	M.	
Meridian Altitude ———————	42	20	South
Sun's Declination ——— ſubtract	10	10	North
The Complement of the Latitude ———	32	10	
Subtract it from ———————	90	0	
The Latitude I am in, is ———	57	50	

Example 2. Being at Sea the 22d of *May*, *Anno* 1783, I find the meridian Altitude to be 65d. 10m. South ; I demand the Latitude ?

		D.	M.	
The Meridian Altitude		65	10	South
The Sun's Declination	ſubtracted	20	25	North
The Complement of the Latitude		44	45	
Sutbract it from		90	0	
The Latitude I am in, is		45	15	North

Example 3. Being at Sea the 27th of *November*, *Anno* 1783, I find the Sun's Meridian Altitude to be 26 deg. 30 min. South; I demand the Latitude I am in?

		D.	M.	
The Meridian Altitude		26	30	South
The Sun's Declination	add	21	11	South
The Complement of the Latitude		47	41	
Subtract it from		90	0	
The Latitude I am in, is		42	19	North

Example 4. At Sea the 25th of *April*, *Anno* 1782, I find the Sun's Meridian Altitude by Obſervation to be 58d. 45m. South; I demand the Latitude I am in?

	D.	M.	
Meridian Altitude	58	45	South
The Declination	13	18	North
The Complement of the Latitude	45	27	
Subtract it from	90	0	
The Latitude I am in, is	44	33	North

Example 5. Admit the 12th Day of *June*, 1782, I find the Sun's Meridian Altitude by Obſervation to be 80 deg. 35 min. North; I demand the Latitude I am in?

		D.	M.	
The Meridian Altitude		80	35	North
Sun's Declination	add	23	11	North
The Sum is		103	46	
From it ſubtract		90	0	
The Latitude I am in, is		13	46	North

Example 6 Admit *Auguſt* 22, 1784, the Sun's Meridian Altitude was obſerved to be 85d. 15m. North; I demand the Latitude of that Place?

		D.	M.	
The Meridian Altitude		85	15	North
Sun's Declination	add	11	32	North
The Sum is		96	47	
From it ſubtract		90	00	
The Latitude of the Place is		6	47	North

Example 7. Admit in a Ship at Sea, *June* 19, 1784, the Sun's Meridian Altitude is 66d. 46m. North; I demand the Latitude the Ship is in?

		D.	M.	
The Meridional Altitude		66	46	North
The Sun's Declination	add	23	28	North
Complement of the Latitude		90	14	
From it ſubtract		90	0	
The Ship is almoſt under the Equinoctial		0	14	North

Examples to find the Latitude, *by obſerving the Stars.*

Example 8. ADMIT I obſerve the *Bull's Eye* upon the Meridian, and find his Meridian Altitude to 50d. 30m. South; I demand the Latitude I am in?

		D.	M.	
The Declination of the *Bull's Eye* is		16	3	North
The Meridian Altitude of the Star		50	30	South
The Star's Declination	ſubtract	16	3	North
Complement of the Latitude, is		34	27	
Subtract it from		90	0	
The Latitude I am in, is		55	33	North

Example 9. Admit I obſerve the bright Star in the *Great Dog's Mouth*, and I find his Meridian Altitude to be 35d. 45m. South; I demand the Latitude I am in?

		D.	M.	
The Declin. of the *Great Dog's Mouth* is		16	25	South
The Meridian Altitude ſo the Star		35	45	South
The Star's Declination	add	16	25	South
The Height of the Equator is		52	10	
Subtract it from		90	0	
The Latitude I am in, is		37	50	North

Example for working an Obſervation in South Latitude.

Example 10. ADMIT the 10th Day of *May*, *Anno* 1782, I find the Sun's Meridian Altitude by Obſervation to be 62d. 0m. North; I demand the Latitude the Ship is in?

		D.	M.	
The Meridian Altitude		62	0	North
The Sun's Declination	add	17	43	North
The Complement of the Latitude is		79	43	
Subtract it from		90	0	
The Latitude the Ship is in, is		10	17	South

Example 11. Admit the 15th Day of *January*, *Anno* 1780, in Longitude 150d. Eaſt, I find the Meridian Altitude by Obſervation to be 38d. 45m. North; I demand the Latitude the Ship is in?

The Sun's Declination in the Meridian of *London*, for the 15th of *January* is 21d. 9m. the daily Difference at this Time is 11m. decreaſing; therefore (in the Table of Proportion) in Page 18, you will find the Proportional Minutes to 5m. which add to the Declination in the Meridian of *London*, the Sum is 21d. 14m. South, the Sun's true Declination for the Longitude of 150d. Eaſt.

		D.	M.	
The Meridian Altitude		38	45	North
The Sun's Declination	ſubtract	21	14	South
Complement of the Latitude, is		17	31	
Subtract it from		90	0	
The Latitude the Ship is in, is		72	29	South

Example 12. Admit the 12th Day of *July*, *Anno* 1783, I find the Sun's Meridian Altitude to be 66 deg. 52 min. North, I demand the Latitude?

		D.	M.	
The Meridian Altitude		66	52	North
The Sun's Declination	add	22	0	North
Complement of the Latitude is		88	52	
Subtract it from		90	0	
Latitude required, is		1	8	South

Example 13. A Ship at Sea, the Sun's Declination being 15d. 30m. South, and the Sun's Meridian Altitude 80d. 45m. South, I demand the Latitude the Ship is in?

Anſw. The Latitude is 6d. 15m. South.

Example 14. The Sun's Declination being 11d. 14m. South, and his Meridian Altitude 79d. 38m. South; I demand the Latitude?

Anſw. The Latitude is 0d. 52m. South.

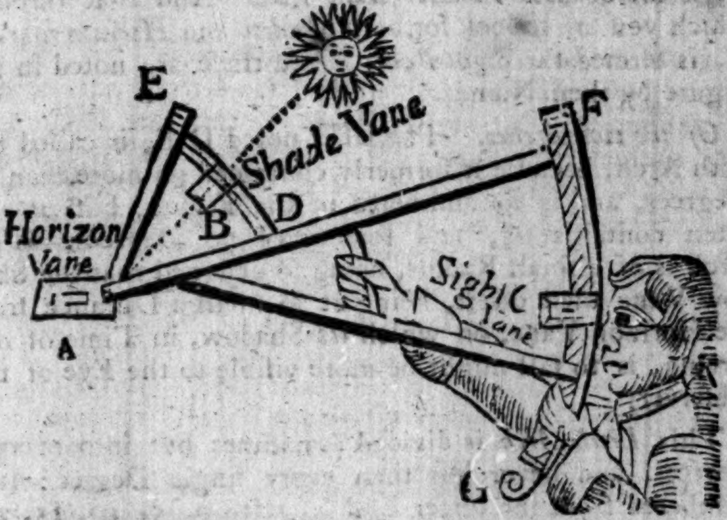
In all theſe Examples the Sun's Altitude is ſuppoſed to be corrected for Refraction, Dip, and Semidiameter, as before taught; but for the Readers further Information, I ſhall ſubjoin an Example at large.

Suppoſe on the 31ſt of July, 1781, an Obſerver 40 Feet above the Level of the Sea finds the apparent Altitude of the Sun's lower Limb to be 56d. 22m. South; and immediately after meaſures the Sun's Diameter with his Quadrant 30m. by which he finds the index error 2m. required the latitude of the place of obſervation?

Appt. Alt. of ⊙s L.L.	56° : 22′	
Index Error added	0 : 2	
	56 : 24	
Dip. for 40 Feet ſub.	0 : 7	
	56 : 17	
⊙s Semidiameter add	0 : 16	
Appt. Alt. of ⊙s Centre	56 : 33	
Refraction ſubtract	0 : 1	Neareſt
True Altitude ⊙s Centre	56 : 32	North
Sun's Declination ſubtract	18 : 10	North
Complement of the Latitude	38 : 22	
Subtract it from	90 : 00	
The Latitude in is	51 : 38	North

The

The Figure of the QUADRANT.



The Deſcription and Uſe of the QUADRANT.

THIS Inſtrument (called a Quadrant, firſt invented by our Countryman Capt. *Davis*, and thence called *Davis's Quadrant*) is of a very commodious Form; at preſent the moſt general approved Inſtrument at Sea (at this Time *Hadley's* particularly excepted) for obſerving the Sun's Meridian Altitude.

The Form of it (as in the Figure prefixed) may be of any Radius or Length between 18 Inches and 3 Feet; but the moſt general now made, are Quadrants of 24 Inches Radius, with one Arch 65 Degrees, the other 25 Degrees, with a Glaſs-Vane and a Shadow-Vane.

The Principal Parts are three Vanes and two Arches; on which Arches the Degrees taken together make 90d. rom whence it hath the Denomination of a Quadrant.

The *Horizon Vane* (marked in the foregoing Figure A, and with its Name) reſpects the Horizon in Time of Obſerving; that which gives the Shadow or lucid Spot marked B, is the *Shadow Vane or Glaſs Vane:* And that through which you are to look for both *Shadow* and *Horizon* marked C, is termed the *Sight Vane.* And theſe are noted in the Figure by their Names.

Of the two Arches. The leſſer noted D E, is called the 60th Arch, becauſe it formerly contained no more than 60 Degrees, and is ſo numbered in the Figure, but now it often contains 65, and ſometimes 70 Degrees. This Arch is of a ſmall Radius, being ſo deſigned that the Shadow Vane uſed on it, being at ſo ſmall a Diſtance from the Horizon Vane, on which its Shadow, in Time of obſerving, is to fall might be more viſible to the Eye of the Obſerver.

This *Little Arch* is divided ſometimes but into every 5 Degrees, and never leſs than every ſingle Degree: It is numbered from the upper End E, with 0, 5, 10, 15, 20, *&c.* downwards to D, where it ends in the Line of ADF, (a Line in the middle of the longer Leg of the Quadrant) at 60, 65, or 70 Degrees, according as the other Arch is divided; ſo that the Numbers at D and F together, muſt always make 90 Degrees.

The *Greater Arch* GF, is called the 30 Arch: It is of a larger Radius, that it may contain the leſſer Diviſions of a Degree; and being of a competent Breadth thereon are uſually deſcribed 9 Concentric Circles, interſected with three Diagonal Lines (ſometimes ſix) in each Degree, making each Interſection two Minutes of a Degree, and ſometimes one.

The *Great Arch* is divided on the Limb into Degrees by long Strokes; each again ſubdivided into ſix equal Parts by ſhorter Strokes; each ſmall Diviſion being 10 Minutes, and are numbered from the lower End G, with 5, 10, 15, *&c.* upwards to F, where it ends in the Line ADF, either at 20, 25, or 30 Degrees: The Figures always at F and K together make 90 Degrees as aforeſaid.

The Uſe of Davis's QUADRANT.

THIS Inſtrument is rarely uſed otherwiſe than to obſerve the Sun's Meridian Altitude; which to perform, I thus deſcribe:

1. Put the Horizon Vane A on the End, and, cloſe to the Center; the Sight Vane put on the Arch GF, cloſe to the Back of it, and the Shadow Vane or Glaſs Vane put on the little Arch DE, cloſe to the back of it, and fix the upper Edge of the Shadow Vane, to a Number of Degrees (on the Side of the 60 Arch) leſs than the Complement of the Altitude by 15 or 20 Degrees.

2. The Vanes being thus fixed upon the Quadrant, turning your back to the Sun, the End G in your Hand, and F uppermoſt, look through the Sight Vane, cauſing the upper Edge of the Shade of the Shadow Vane, or lucid Spot from the Glaſs Vane to lie upon the upper Edge of the Slit in the Horizon Vane, where is drawn a black Line; at the ſame Time if the Horizon appear through the ſaid Slit in the Horizon Vane, the Vanes on the Quadrant ſtand at the Sun's preſent Altitude

3. But if the Sky appear inſtead of the Horizon, ſlide the Sight Vane a little higher towards F; on the contrary, if the Sea appear inſtead of the Horizon, then ſlide the Sight Vane lower towards G; continue ſo to do till the Horizon appear through the Horizon Vane.

4. In order to obtain the Meridian Altitude (which is the greateſt Altitude the Sun will have that Day, which is uſed to find the Latitude) continue obſerving; and as the Sun riſes the Sea will appear through the Horizon Vane; and the Sight Vane muſt be ſlid lower accordingly. Thus continue obſerving as often as may be convenient, till the Sun is at the higheſt.

5. When the Sun begins to fall, the Sky will appear through the Horizon Vane, inſtead of the Horizon; then deſiſt obſerving any more that Day.

6. Having thus done, add the Degrees the upp r Edge of the Shade Vane ſtandeth at, to the Degrees and Min. cut by the inſide of the Sight Vane, their Sum isthe Com-

plement of the Sun's Meridian Altitude, or the Diſtance on the upper Edge of the Sun from the Zenith, to which Sum add 16m. the Sun's Semi-diameter, and the laſt Sum is the Diſtance of the Sun's Center from the Zenith, being the true Complement of the Sun's Meridian Altitude.

Note, The upper Edge of the Shade of the Shadow Vane reſpects the upper Limb of the Sun, and the lower Edge of the ſaid Vane anſwers to the lower Limb of the Sun; ſo that obſerving by the firſt, you are to add 16 Minutes; on the contrary, obſerving by the latter, ſubtract 16 Minutes to, or from what is on the Quadrant, the Sum or Difference is the Diſtance of the Sun's Centre from the Zenith, called his Zenith's Diſtance or Complement of his Meridian Altitude.

Thus I have ſhewn how to take an Obſervation with this Quadrant: I come now to ſhew how to work it. The Difference in working an Obſervation taken by Hadley's Quadrant and this is: By Hadley's you take the Altitude, by this the Complement of the Altitude, or the Diſtance of the Sun from the Zenith.

Altitude is the Diſtance of the Sun from the Horizon; therefore if you ſubtract the Complement of the Altitude from 90d. the Remainder is the Altitude.

But it is uſual to work Obſervations, made by this Quadrant, by the Complement of the Sun's Meridian Altitude; I will therefore give ſome general Rules, and ſome particular Examples for their Explanation.

The General Rules are,

1. IF the Sun hath North Declination, and is upon the Meridian to the Southward of the Obſerver, add the Sun's Declination to the Zenith Diſtance, (or Complement of the Sun's Meridian Altitude) the Sum is the Latitude you are in, North.

2. If the Sun be to the Southward of you, and hath South Declination, ſubtract his Declination from the

Zenith Diſtance, the Remainder will be the Latitude you are in, North: But if the Declination exceed the Zenith Diſtance, ſubtract the leſs from the greater, and the Remainder is the Latitude, South.

3. If the Sun be to the Northward of you, and hath South Declination, add the Sun's Declination to his Zenith Diſtance, the Sum will be the Latitude, South.

4. If the Sun be to the Northward of you, and hath North Declination, ſubtract the Sun's Declination from his Zenith Diſtance, the Remainder will be the Latitude South; but if the Declination exceed the Zenith Diſtance, ſubtract the leſs from the greater, and it gives the Latitude, North.

I might have given more general Rules; but if you underſtand thoſe eight Rules for the Uſe of Hadley's Quadrant, you cannot err in theſe: And for their Explanation, ſee the Examples following.

Working an Obſervation in North Latitude.

Example 1. ON the 10th of *April*, 1780, the Sun came to the Meridian in the South, and by Obſervation, found his Zenith Diſtance, or Complement of his Meridian Altitude to be 34d. 47m. that is, his upper Limb was ſo much from the Zenith; I demand the Latitude of the Place of Obſervation?

		D.	M.	
Compl. of the Sun's Meridian Altitude	-	34	47	South
The Sun's Semidiameter	- - - - - -	0	16	
Diſtance of the Sun's Centre from Zenith		35	3	South
Declination	- - - - - - - add	8	17	North
Latitude of the Place required, is	- -	43	20	North

Example 2. The 14th Day of *Auguſt*, *Anno* 1780, I find the Complement of the Sun's Meridian Altitude by Obſervation, to be 28d. 48m. South; I demand the Latitude the Ship is in?

		D.	M.	
Comp. of the Sun's Meridian Altitude -		28	48	South
Sun's Semidiameter - - - - - -	add	0	16	
Diſtance of the Sun's Center from Zenith		29	4	South
The Sun's Declination - - - - - -	add	14	8	North
The Latitude the Ship is in, is - - -		43	12	North

Example 3. *October* 3, 1780, I find the Complement of the Sun's Meridian Altitude, by Obſervation to be 47d. 35m. South, I demand the Latitude I am in?

		D.	M.	
Comp. of the Sun's Meridian Altitude -		47	35	South
Sun's Semidiameter - - - - - -	add	0	16	
Diſtance of the Sun's Center from Zenith		47	51	South
The Sun's Declination - - -	ſubtract	4	18	South
The Latitude the Ship is in, is - - -		43	33	North

Example 4. The 5th Day of *November*, *Anno* 1782, I find the Complement of the Sun's Meridian Altitude by Obſervation to be 52d. 0m. South; I demand the Latitude the Ship is in?

		D.	M.	
Comp. of the Sun's Meridian Altitude -		52	0	South
Sun's Semidiameter - - - - - - -	add	0	16	
Diſtance of the Sun's Center from Zenith		52	16	South
The Declination of the Sun -	ſubtract	15	49	South
The Latitude the Ship is in, is - - -		36	27	North

Example 5. The 27th of *May*, 1782, the Sun being to the Northward of me, and the Complement of his Meridian Altitude by Obſervation 10d. 15m. I demand the Latitude the Ship is in?

		D.	M.	
Sun's Declination - - - - - - - -		21	22	North
Comp. of the Sun's Meridian Altitude -		10	15	North
The Sun's Semidiameter - - - -	add	0	16	
The Sun's true Zenith Diſtance,	ſubtract	10	31	North
Latitude the Ship is in, is - - - - -		10	51	North

Example 6. Admit on the 29th Day of *June*, *Anno* 1782, the Sun being upon the Meridian, I find, by Obſervation, his upper Limb to be 6d. 42m. to the Northward of my Znith; I demand the Latitude I am in?

D.

	D.	M.	
Sun's Declination - - - - - - - - -	23	14	North
Sun's upper Limb from the Zenith ———	6	42	North
Sun's Semidiameter - - - - - - - add	0	16	
Diſt. of the Sun's Center from Zenith ſub.	6	58	North
Latitude the Ship is in, is - - - - -	16	16	North

Example 7. The 21ſt of *July*, *Anno* 1780, in Longitude 165 Deg. Weſt, and the Sun being upon the Meridian, I find by Obſervation, the upper Margin of the Sun is 16d. 45m. to the Northward of the Zenith; the Latitude the Ship is in, is required?

	D.	M.	
The Sun's Declination at *London* - - -	20	20	North
Proportional Min. for Longitude ſubtract —	0	15	
Sun's Declination in the Meridian given	20	15	North
Sun's upper Limb from the Zenith ———	16	45	North
Sun's Semidiameter - - - - - - add	0	16	
Sun's Central Diſt. from Zenith ſubtract	17	1	North
The Latitude the Ship is in, is - - - - -	3	14	North

Working an Obſervation in South Latitude.

Example 8. ON the 14th Day of *July*, *Anno* 1790, in Longitude 150 Deg. Eaſt, the Sun being upon the Meridian, I find the Complement of his Meridian Altitude, by Obſervation, to be 48d. 28m. North; I demand the Latitude the Ship is in?

	D.	M.	
Comp. of the Sun's Meridian Altitude add	48	28	North
Sun's Semidiameter - - - - - - -	0	16	
Sun's Central Diſtance from the Zenith -	48	44	North
Sun's Declination for the Long. ſubtract -	21	43	
The Latitude the Ship is in, is - - -	27	1	South

Example 9. The 25th of *October*, *Anno* 1789, in Longitude 120 Deg. Weſt, the Complement of the Sun's Meridian Altitude, by Obſervation, is 27d. 29m. North; I require the Latitude the Ship is in?

	D.	M,	
Comp. of the Sun's Meridian Altitude -	27	29	North
Sun's Semidiameter - - - - - - add	0	16	
Sun's Central Diſtance from the Zenith -	27	45	North
The Declination of the Sun's Prop. add	12	29	South
The Latitude the Ship is in, is - - -	40	14	South

Example 10. Admit that on the 24th of *December*, *Anno* 1786, I find the Sun upon the South Part of the Meridian, and by Obſervation the Complement of his Meridian Altitude is 15d. 10m. I demand the Latitude the Ship is in?

	D.	M.	
Comp. of the Sun's Meridian Altitude -	15	10	South
Sun's Semidiameter - - - - - - add	0	16	
Sun's Central Diſt. from the Zenith ſubtract	15	26	South
The Declination of the Sun - - - -	23	26	South
The Latitude the Ship is in, - - -	8	0	South

In theſe Examples to Davis's Quadrant, neither Dip, nor Refraction are ſuppoſed to be noticed as the Inſtrument in its Conſtruction, is not ſufficiently accurate for nice Corrections.

Note 1. The Sun's Semidiameter here added to the Complement of its Meridian Altitude, may be placed on the Quadrant, ſo that its Addition by the Pen may be omitted; for this Purpoſe the Quadrants have on the back Edge of the little Arch (every 5 Degrees numbered, differing from thoſe on the flat Side) the Semidiameter of the Sun: So that placing the upper Edge of the Shadow Vane, to the Degree on the ſaid back Edge of the Arch, the Quadrant then ſheweth the true Complement of the Altitude, or the Diſtance of the Sun's Center from the Zenith; which prevents adding 16 Minutes after obſerving.

Note 2. There is another Contrivance now made uſe of, which is, by fixing a Convex Glaſs in ſuch a Manner in the Shade Vane, that the Diameter of the Glaſs may exactly range with the upper Edge of the ſaid Vane, and which Glaſs will then, in Time of Obſervation, caſt an illuminated Spot on a round black Spot made in the Horizon Vane: This is uſeful when the Edge of the Shadow reflected from the Shade Vane is not very conſpicuous, the Spot being diſcernable when the latter is not: The Manner is thus:

Set that Part of the Glaſs Vane, which is right againſt the Middle or Center of the Glaſs, to the Degrees on the Side of the little Arch, and then cauſe the enlightened Spot of the Glaſs to lie on the black Spot or Circle on the Horizon Vane; at the ſame Time look for the Horizon thro' it, as before directed, ſo you will have (obſerving by this Glaſs in the Vane) the true Complement of the Sun's Altitude, or the Diſtance of his Center from the Zenith.

The Deſcription of the NOCTURNAL.

1. THE *Nocturnal* conſiſts of three Parts; the firſt termed the unmoveable Part is the broadeſt and greateſt; on which is a Handle to hold it by in Time of Obſervation of uſing it.

On the fore Side of which, in the outermoſt Circle, are the twelve Months, and each Month ſubdivided into its reſpective Days; they are counted towards the left Hand, from the Tip, or nearly ſo, when you hold it erect by the Handle, and marked with their Names, or the firſt Letters thereof; as *Jan.* for *January*, *Feb.* for *February*, *Mar.* for *March*, &c. Within the Circle of the Months is a Circle divided into 24 equal Parts or Hours, each Hour divided into Halves and Quarters; uſed to find the Time of full Sea or high Water.

On the back Side of this Part, are the 32 Points of the *Mariner's Compaſs* South Uppermoſt, and Eaſt on the Left Hand; to each Point is ſet the Declination of the North Star, above or under the Pole; which is known by *Und.* for *Under*, *Abo.* for *Above.*

Formerly there was made two Sorts of Nocturnals, one for the Great Bear, the other for the Little Bear: Thoſe made for the Guards, of the Great Bear, or *Charles's Wain*, commonly called the two Pointers, have *February* at the Top; but thoſe made for the Guards of the Little Bear, have *April* at the Top; but they are now made for both Bears in one Nocturnal, and are known by having either two Circles or Months, mark'd GB and LB, or two ſhort Teeth or Indices, proceeding from the ſecond or middle Part of it marked GB and LB, ſignifying Great Bear, or Little Bear.

2. The ſecond moveable middle Part hath two Circles on it; the outermoſt is divided into the 29 Days and a Half of the Moon's Age; the innermoſt is divided into 24 equal Parts or Hours, each Hour ſubdivided into Halves and Quarters; this Part hath a Tooth, or ſhort Index proceeding from it with the Edge continued in a right Lin from the Center, which is to be ſet to the Day of the Month when uſed. Some have two Indices, marked G on one and L on the other; G ſtands for Great Bear, and L for Little Bear; ſignifying the Nocturnal is made for both Bears, and may be uſed for either.

3. The third and moveable Part is called the Index; is uppermoſt on the fore Side of the Inſtrument, having one Edge proceeding in a right Line from the Center, which (in the Time of Obſervation) muſt be turned to the Guards. Through all three Pieces, in the Center of the Inſtrument, is a Hole, through which you are to ſee the North Star, when the Index is turned to the Guards.

The Deſcription and Uſe of Gunter's Scale.

THIS Inſtrument for its quick and eaſy Diſpatch of the moſt common and uſeful Proportions, deſerves as generally to be known in its Uſes as by its Name: On that Account we ſhall firſt give a Deſcription thereof, and then, with as much Clearneſs and Brevity as poſſible, ſhew its manifold Uſes.

1. *Gunter's Scale*, (ſo called from Mr. *Gunter*, its firſt Contriver) is uſually made of Box Wood, commonly two Feet long, and one Inch and a half broad; on which are placed the Lines or Scales of Numbers, Sines, Tangents, *&c.* There are two Sorts, the long or flat Gunter, and the ſliding Gunter: On both Sorts are the ſame Lines, though differently uſed; the firſt Sort with the Compaſſes, the latter by ſliding Pieces.

2. The Lines generally ſet on *Gunter*'s are eight, and have their Names at the Right Hand End thereof, under one another, thus; Sine Rumb, Tang. Rumb, Numbers Sines, Verſed Sines, Tangents, Meridian (or Meridional Parts) and equal Parts.

3. The Sine Rumb, and Tang. Rumb, are both Points of the *Mariner's Compaſs*; the firſt is figured from the Left Hand towards the Right, with 1, 2, 3, 4, 5, 6, 7, and 8, at which is a Braſs Center Pin; the latter is figured thus, 1, 2, 3, and 4, at the ſaid Center Pin; and thence back again towards the Left-Hand with 5, 6, and 7; each Point in both Lines (where it can) is ſubdivided into Halves and Quarters: Theſe two Lines are only uſed in Navigation.

4. The next under Tang. Rumb, is the Line of Numbers figured thus: Near the Left Hand End it begins at 1, and towards the Right Hand is 2, 3, 4, 5, 6, 7, 8, 9; then 1 is the middle, at which is a Braſs Center Pin going ſtill on 2, 3, 4, 5, 6, 7, 8, 9, and 10, at the End where is another Center Pin: This Line is of general Uſe, and requires the larger Account, whereof take theſe three following Notes for the Line of Numbers.

Note 1. *All the Figures on this Line may be taken ſingly as they ſtand; or be increaſed or diminiſhed at Pleaſure, ſo it be in Decuple or ten-fold Proportion.* That is, the firſt 1 may be counted for 1, or 10, or 100, or 1000, *&c.* then the next 2 is accordingly 2, or 20, or 200, or 2000, *&c.* Again, the firſt 1 may be reckoned for 1 Tenth, or 1 Hundreth, or for 1 Thouſandth Part, *&c.* then the next 2 is 2 Tenths, or 2 Hundredths, or 2 Thouſand Parts, *&c.* So that if the Firſt 1 be eſteemed 1, the middle 1 is then 10; and two to its Right-hand is then 20, 3 is 30, 4 is 40, and 10 at the end is 100. Again, if the firſt 1 be counted 10, the next 2 is 20, 3 is 30, and ſo on, making the Middle 1 now 100; the next 2 is 200, 3 is 300, 4 is 400, and 10 at the End is now 1000.

In like Manner, if the firſt 1 be eſteemed for 1 Tenth Part, the next is 2 Tenths, and the middle 1 is 1; and the next 2 is 2, and 10 at the End is now 10. Again, if the firſt 1 be counted for 1 Hundredth Part, the next 2 is 2 Hundred Parts; the Middle 1 is now 10 Hundred Parts, or 1 Tenth Part, and the next 2 is 2 Tenth Parts; and 10 at the End is now but 1 whole Number or Integer.

Note 2. *As the Figures are increaſed or diminiſhed in their Value, ſo in like Manner muſt all the intermediate Strokes or Subdiviſions be increaſed or decreaſed:* That is, if the firſt 1 (at the left Hand) be counted 1, then 2 (on the right Hand of it is 2; and each Subdiviſion between them now is one Tenth Part, and ſo all the Way to the Middle 1, which now is 10; the next 2 is 20. Now the longer Strokes between 1 and 2 are to be counted from 1, thus 11,

12,

12, (where is a Braſs Pin) then 13, 14, 15, (ſomething a longer Stroke than the reſt) then 16, 17, 18, 19, and 20, at the Figure 2: And all the ſhorter Strokes between thoſe longer are now each to be counted for a Tenth Part; from the Middle 1 to the next 2, now 20; from whence the longer Strokes between the Figures are Units, thus 21, 22, 23, *&c.* to 3, which now is 30; and the ſhorter Strokes between them, each now is 2 Tenth Parts of an Integer: From 3, each ſhort Stroke (or little Diviſion) is five Tenth Parts of an Unit.

Again, If 1 at the left Hand be Ten, the Figures between it and the middle 1 are common Tens, and the Subdiviſions (between each Figure) are Units, and from the Middle 1 to 10 at the End, each Figure is ſo many Hundreds; and between theſe Figures, each longer Diviſion is 10 and from the Middle 1 to 2, each leſs Diviſion is an Unit; and from 2 to 3, each leſs Stroke is two Units; from the Figure 3 to the End, each ſhorter Stroke is five Units.

Some Scales are otherwiſe ſubdivided, which the Reader will attend unto, and thence very eaſily aſcertain the Value of each Subdiviſion, if what is aforementioned be duly underſtood.

Note 3. On the *Line of Numbers* may be counted a Number of any Denomination; whether Meaſure, as Inches, Feet, Yards, Miles, Leagues, *&c.* or Weights, as Hundreds, Pounds, Ounces, *&c.* or Money, as Pounds, Shillings, Pence, *&c.* or Time, as Years, Months, Days, Hours, *&c.* provided always the Integer be divided, or ſuppoſed to be divided decimally, or into Tens.

5. Next under Numbers, is the Line of *Sines*, beginning at the left Hand, and figured thus, 1, 2, 3, *&c.* to 10; then 20, 30, 40, *&c.* to 90, ending at the right Hand, where is a braſs center Pin. Theſe Figures never change their Value or Denomination, being here (and in all other Lines under it) called Degrees.

From the Beginning of this Line to 10 Degrees, each Degree is commonly divided into 12 Parts, by longer and ſhorter Strokes, making each 5 Minutes; from 10 Degrees to 20, each ſmaller Stroke is 10 Minutes; from 20 to 30 Degrees each is fifteen Minutes from thence to 60 Degrees, ſome are twenty, but the moſt are thirty Minutes; and from 60 to 80 Degrees, each Diviſion is a Degree; 80 and 90 are ſo near together, that they admit but of one Stroke between them, which is for 85 Degrees.

6. Next to the Line of Sines, is the *Line* of *Verſed Sines*, beginning at the right Hand againſt 90, (in the Sines) and from thence figured towards the Left-hand; thus, 10, 20, 30, 40, *&c.* ending at (the left Hand End) about 169 Degrees; the Subdiviſions are thus, from 10 to 30, each is 2 Degrees; from thence to 90, it is ſingle Degrees; from thence to 120, it is half Degrees; and from thence to the End it is divided each into 15 Minutes.

7. *Under verſed Sines* is the *Line of Tangents*, beginning at the left Hand, as the *Sines* do; from thence figured to the right Hand thus, 1, 2, 3, *&c.* to 10; and ſo on, 20, 30, 40, and 45 at the right Hand, where is a little Braſs Center Pin, juſt under and even with 90 in the *Sines*; from thence back again it is figured, 50, 60, 70, 80, *&c.* to 89; ending at the Left Hand End, where it began at 1 Degree: The Subdiviſions of the Line are the ſame of thoſe of the Sines.

8. Next to the Line of *Tangents*, and under it is the *Line of Meridional Parts*, beginning at the right Hand, and numbered thus, 10, 20, 30, *&c.* to the left Hand, where it ends at 87 Degrees. This Line, with the *Line of equal Parts* under it, are uſed together, only in the *Mercator's Sailing*; the uppermoſt Line contains the Degrees of the Meridian or Latitude in a *Mercator's* Chart, and the lower is the Equator, and contains the Degrees of Longitude.

9. Theſe eight Lines, thus deſcribed, are ſet on the *Sliding Gunter*, but not in the ſame Order, being ſome on one Side, and ſome on the other: Alſo the Line of Numbers, Sines, and Tangents, are ſet double, that is,

one on each Side, as the middle Piece ſlides; which middle Piece is ſo contrived, as to ſlip to and fro eaſily; to ſlide out, and to be put in, any Side uppermoſt, in order to range theſe Lines together or againſt one another, moſt proper for ſolving the Queſtions wrought by the *Sliding Gunter*; of which, this ſhort Deſcription may ſuffice.

I. *The Uſe of* Gunter's Scale, *both ſingle and ſliding, in* Arithmetic.

IN order to a right Underſtanding of the Uſe of this Scale, it is neceſſary to number well on it; that is, to find readily a Place repreſenting any given Number, Point, or Degree, *&c.* but chiefly on the Line of Numbers, which is as follows:

PROBLEM I. *To find a whole Number on the Line of Numbers.*

Rule 1. LOOK the firſt Figure of the given Number among the figured Diviſions.

2. For the ſecond Figure, count ſo many Tenths, (or onger Strokes) from the figured Diviſions, towards the ight Hand, as there are Units in the ſaid ſecond Figure.

3. Then for the third Figure, count from the laſt Tenth (repreſenting the ſecond Figure) ſo many leſs Strokes (or Centeſſimals) as that Figure hath Units.

4. In like Manner, for the fourth Figure, count from the laſt Centeſſimal ſo many Thouſands (or leſs Strokes) as are Units in it; and ſo on, for more Figures, though four Figures, or Thouſands, are as many as can well be diſcerned on a two-foot Gunter.

5. This done, the laſt Place is the Point where the propoſed Number is repreſented.

Example 1. To find the Point in the Line of Numbers that doth repreſent 12.

According to the Rule above, I take the Diviſion at the Figure 1 (in the Middle of the Line of Numbers) for the firſt Figure of 12, the propoſed Number; then for 2 the ſecond Figure I count 2 Tenths (or longer Strokes to the right Hand) from the ſaid Stroke at 12; and this laſt is the Point repreſenting 12, where there is moſt commonly a ſmall Braſs Centre Pin, being oft in Uſe. *Example*

***Example* 2.** Suppoſe the Point repreſenting 22, on the Line of Numbers, was required to be found?

The firſt Figure in the Number 22, being 2, I take the Diviſion in the Figure 2 for it; and for the ſecond Figure 2, I count 2 Tenths onwards: And that is the Point repreſenting 22.

***Example* 3.** I deſire to know the Point on the Line of Numbers that repreſents 144.

The firſt Figure being 1, I take the Diviſion at the Middle 1 for it; the ſecond Figure being 4, I count 4 Tenths onwards, and that is 140; from thence count 4 Centeſſimals farther, for the third and laſt Figure; this laſt Place is the Point repreſenting 144.

***Example* 4.** Let it be required to find, on the Line of Numbers, the Point repreſenting 1728.

For the firſt Figure 1, take the Middle 1, for the ſecond Figure 7, count, as before onward, 7 Tenths, and that is 1700: Then for 2, the third Figure, count 2 Centeſſimals from the laſt, and it repreſents 1720: Laſtly, for the fourth Figure 8, eſtimate 8 Thouſand Parts from the laſt. This Point laſt found repreſents 1728?

PROB. II. *To find a Fraction, or broken Number, on the Line of Numbers.*

THE Fractions to be found on this Line muſt always be Decimals; as theſe, .1 .01 .001; .2 .02. 002, *&c.* that is, $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$; $\frac{2}{10}$, $\frac{2}{100}$, $\frac{2}{1000}$, *&c.* one Tenth, one Hundredth, one Thouſandth, two Tenths, two Hundredths, two Thouſandths, *&c.* either of Inches, Feet, Yards, Miles, or the like; in Weight, Time, or any other Denomination.

All Fractions muſt be reduced into Decimals, before they can be found on the Line of Numbers; and being ſo reduced, they are expreſſed and found upon this Line as whole Numbers by *Problem* I.

Thus 172,8, that is 172 and 8 Tenths, is found upon the Line of Numbers juſt the ſame as 1728, but in Value it is ten Times leſs.

PROB. III. *To perform Multiplication by the Line of Numbers.*

The RULE is,

As 1 is to the Multiplier, ſo is the Multiplicand to the Product.

Now to work this, or any Proportion on the *Gunter*; this is a general Rule.

1. Extend the Compaſſes from the firſt Term to the ſecond Term.

2. That Extent laid the ſame Way from the third Term, will reach to the fourth Term, or Thing required.

By the *Sliding Gunter* thus;

1. Set the firſt Term counted on the ſliding or middle Piece, right againſt the ſecond Term counted on the fixed Piece.

Then ſeek the third Term, (always on the ſame Piece the firſt Term was counted upon) and againſt it on the fixed Piece, is the fourth Term, or Thing required.

Example 1. What is the Product of 8 multiplied by 4?

The Analogy or Proportion is this: As 1 is to 4, ſo is 8 to the Product, which is 32.

Or as 1 is to 8, ſo is 4 to the Product 32.

1. By the *Gunter* with Compaſſes, thus;

Extend the Compaſſes from 1 to 4; that Extent laid from 8 (the ſame Way) reacheth to 32, the Product of 8 multiplied by 4.

Or the Extent from 1 to 8, being laid from 4, reacheth to 32, the Product as before.

2. By the *Sliding Gunter*, thus;

Set 1 at the Beginning of the middle or ſliding Piece, right againſt 4 on the fixed or outſide Piece; then againſt 8 on the firſt, is 32 on the ſecond, the Product required.

Or ſet 1 againſt 8; then againſt 4 on the firſt, is 32 on the ſecond, the Product, as before.

Example 2. What is the Product of 16, multiplied by 5?

The Proportion to work it by, is this: As 1 is to 5, ſo is 16 to 80 the Product.

1. By *Gunter* with Compaſſes, it is thus;

The Extent from 1 to 5 being laid from 16, reacheth to 80 the Product required.

2. By the *Sliding Gunter* thus;

Set 1 on the middle Piece, againſt 5 on the outſide Piece, then againſt 16 on the firſt, is 80 on the ſecond, the Product as before.

PROB. IV. *To perform Diviſions by the Line of Numbers.*

The Rule or Proportion is thus;

AS the Diviſor is to 1, ſo is the Dividend to the Quotient.

Example 1. If the Dividend be 64, and the Diviſor 4, what is the Quotient?

To do this, the Proportion is: As 4 is to 1, ſo is 64 to 16, the Quotient required.

1. By *Gunter* with Compaſſes, thus;

The Extent from 4 to 1 (laid the ſame Way) from 64 reacheth to 16.

2. By the *Sliding Gunter*, thus;

Set 4 on the outſide Piece, againſt 1 on the Middle Piece; then againſt 64 on the firſt, is 16 on the ſecond, which is the Quotient as before.

Example 2. How often is 144 contained in 1728?

To do this, the Proportion is thus: As 144 is to 1, ſo is 1728 to the Anſwer, *viz.* 12.

1. By *Gunter* with Compaſſes, thus;

The Extent from 144 to 1, reacheth from 1728 to 12, the Quotient or Anſwer required.

2. By the *Sliding Gunter*, thus;

Set 144 on the outſide Piece, againſt 1 on the middle Piece; then againſt 1728 on the firſt, is 12 on the ſecond, which is the Quotient as above.

PROB. V. *To reduce a Vulgar Fraction to a Decimal by the Line of Numbers.*

TO perform this, the Proportion is thus: As the Denominator or upper Figure of the given Fraction is to its Numerator, or lower Figure, ſo is 1 to the Decimal Fraction required.

Example. Suppoſe it be required to reduce $\frac{3}{4}$, a Vulgar Fraction, into a Decimal Fraction?

Note, A Decimal Fraction hath for its Denominator an Unit, with as many Cyphers as its Numerator hath Places, and the Proportion to find the Numerator is thus; As 4 is to 3, ſo is 1 to the Numerator of the Decimal Fraction required.

1. By *Gunter* with Compaſſes, thus;

The Extent from 4 to 3 reacheth (the ſame Way) from 1 to ,75, or $\frac{75}{100}$ the Decimal Fraction required.

2. By the *Sliding Gunter*, thus;

Set 4 on the outſide Piece, againſt 3 on the middle Piece; then againſt 1 on the firſt is ,75, or $\frac{75}{100}$, on the ſecond, the Decimal Fraction required to be found: So that .75, or $\frac{75}{100}$ is equal in Value to $\frac{3}{4}$.

PROB. VI. *Of continued or Geometric Progreſſion: which is unto two given Numbers, to find a* 3d, 4th, 5th, *&c. Number, in continued Proportion by the Line of Numbers.*

The Analogy by which it is effected, is thus;

AS the firſt given Number is to the ſecond, ſo is the ſecond to the third, and ſo is that third to a fourth, and that fourth to a fifth, *&c.*

Example. Let the two Numbers given be 2 and 4, unto which it is required to find a third, fourth, *&c.* Proportional.

To perform which, the Ruſe is:

As 2 is to 4, ſo is 4 to a third; and ſo is that third to a fourth, *&c.*

1. By *Gunter* with Compaſſes, thus;

The Extent from 2 to 4 reaches from 4 to 8, the third; and from 8 to 16, the fourth; and from 16 to 32, the fifth proportional Number; and ſo on, to as many as you pleaſe: So that 2, 4, 8, 16, 32, *&c.* are Numbers in continued Geometric Proportion.

2. By the *Sliding Gunter* thus;

Set 2 on the middle Piece, to 4 on the outſide Piece: then againſt 4 on the firſt, is 8 on the Second, for the third Proportional; and againſt 8 on the firſt is 16 on the ſecond, the fourth Proportional; and in like manner againſt 16 is 32, the fifth Proportional, as was required: And ſo on for more.

PROB. VII. *Of the Rule of Three Direct, or three Numbers being given, to find a fourth in a direct Proportion by the Line of Numbers.*

The Analogy whereby this is performed, is thus:

AS the firſt Number is to the ſecond, ſo is the third to the fourth Number required.

Example 1. If the Diameter of a Circle be 7 Inches, and the Circumference thereof 22, what is the Circumference of a Circle, whoſe Diameter is 14 Inches?

To perform this, the Analogy is thus; as 7 is to 22, ſo is 14 to the Circumference required.

1. By *Gunter* with Compaſſes, thus;

The Extent from 7 to 22 (laid the ſame Way) from 14, will reach to 44, the Circumference of the Circle, whoſe Diameter is 14, which was required.

2. By the *Sliding Gunter*, thus;

Set 7 on the middle Piece, againſt 22 on the outſide Piece; then againſt 14 on the firſt, is 44 on the ſecond, which is the Circumference as above.

Example 2. If the Circumference of a Circle be 3.14 or 3 $\frac{14}{100}$, and its Diameter 1, what will the Diameter of another Circle be, whoſe Circumference is 44?

The Proportion is, as 3 $\frac{14}{100}$ is to 1, ſo is 44 to the Diameter required.

1. By *Gunter* with Compaſſes, thus;

The Extent from 3 $\frac{14}{100}$ to 1, reacheth from 44 to 14 nearly, the Diameter required.

2. By the *Sliding Gunter*, thus;

Set 3 $\frac{14}{100}$ on the outſide Piece, right againſt 1 on the middle Piece; then againſt 44 on the firſt, is 14 on the ſecond, which is the Diameter required, as before.

Note, In the *Rule of Three Direct*, if the third Number be greater than the firſt, then will the fourth Number be greater than the ſecond: But if the third Number be leſs than the firſt, then the fourth will be leſs than the ſecond.

Example 3. If 30 Acres of Land be worth 25 Pounds a Year, how much a Year will 54 Acres be worth? A

To do this, or any Queſtion in the *Rule of Three*, always in the Proportion let the firſt and third Numbers or Terms be of one Kind or Denomination, and then it is thus: As 30 Acres is to 25 Pounds, ſo is 54 Acres to 45 Pounds.

1. By the *Gunter* with Compaſſes, thus;

The Extent from 30 to 25, reacheth from 54 to 45, the yearly Rent required.

2. By the *Sliding Gunter*, it is thus;

Set 30 againſt 25, then againſt 54 on the firſt, is 45 on the ſecond, as before.

By this Time the Reader is, we preſume, ſo well acquainted in the Way of working a Proportion on the Line of Numbers, either by the ſliding or plain Gunter, that it is needleſs to expreſs it in Words any more, being always the ſame: We ſhall therefore for the future ſet down the Proportion, leaving the Manner of its Operation to Practice, except in Caſes where the working differs from the preceding.

PROB. VIII. *Of the Rule of Proportion Inverſe, or three Numbers given to find a fourth in an Inverſe Proportion, or in the backward Rule of Three, by the Line of Numbers.*

IN this Rule you muſt note, if the third Number be greater than the firſt, then will the fourth be leſs than the ſecond. But,

2. If the third be leſs than the firſt, the fourth is to be greater than the ſecond.

3. And to reſolve Queſtions in the backward Rule of Three, the Proportion is thus;

As the third Number is to the ſecond, ſo is the firſt to the fourth.

Example. If 72 Pioneers make a Trench in 48 Hours, in how long Time will 54 Pioneers make it?

By the Directions above, this is the Proportion: As 54 Men is to 48 Hours, ſo is 72 Men to 64 Hours, the Anſwer to the Queſtion, from whence you may conclude that 54 Men will perform as much in 64 Hours, as 72 Men in 48 Hours.

PROB. IX. *Of Duplicate Proportion, or three Numbers being given, to find a fourth in a Duplicate Proportion by the Line of Numbers.*

THIS Rule is chiefly uſed in Proportion of Lines to Superficies, *&c.* wherein the firſt and ſecond Terms are to be of one Kind or Denomination.

Example 1. If the Diameter of a Circle be 1, and its Area or Content 0.78539, what is the Content of a Circle whoſe Diameter is 14?

To perform this, the firſt and ſecond Terms, (by the Note above) are to be Lines; that is, the Diameters given, and then the Proportion is thus: As 1 is to 14; ſo is 0.785 to a fourth; and ſo is that fourth to the Content required.

1. By *Gunter* with Compaſſes, thus;

The Extent from 1 to 14 reacheth from 0.785 to 11; and the ſame Extent laid the ſame Way from 11 reacheth to 154, the Content required.

2. By the *Sliding Gunter*, it is thus;

Bring 1 on the middle Piece right againſt 14 on the outſide Piece; then againſt 0.785 on the firſt, is 11 on the ſecond; and againſt 11 on the firſt, is 154 on the ſecond, the Content as before.

Example 2. If the Diameter of a Circle be 7, and its Area 38.5 what is the Area of a Circle whoſe Diameter is 12? *Anſwer* 113. For,

As 7 is to 12, ſo is 38.5 to 66; and ſo is 66 to 113, the Area required.

Example 3. If the Diameter of a Circle be 1, and its Area 0.785, what is the Diameter of a Circle whoſe Area is 154? *Anſwer*, 14 is its Diameter.

In this, the Proportion is a Superficies to a Line, which is thus: As Area 0.785 is to Area 154, ſo is the Square of the Diameter 1, to the Square of the Diameter required.

1. By *Gunter* with the Compaſſes, it is thus;

The Extent from 0.785 to 154 reacheth from 1 to 196 the Square of the Diameter required.

Then divide the Space between 1 (always the Middle 1) if the Number of Places be odd, but if even, the firſt 1) and 196 into two equal Parts; the Foot of the Compaſſes in the Middle reſteth at 14, the Diameter of the Circle, whoſe Area is 154.

2. By the *Sliding Gunter*, it is thus;

Set 0.785 againſt 154, and againſt 1 on the firſt, is 196 on the ſecond; then find the Middle between 1 and 196 which is at 14, the Diameter as before.

Example 4. The Diameter of a Circle being 1, and its Area 0.785, what is the Diameter of a Circle whoſe Are is 113? *Anſwer*, 12 is the Diameter required.

For as 0.785 is to 113: ſo is 1 to 144; the Middle between it and 1, is 12, the Diameter required.

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PROB. X. *Of Triplicate Proportion, or three Numbers being given to find a fourth in a Triplicate Proportion by the Line of Numbers*

THIS Problem concerneth the Proportion of Lines to Solids, and the contrary; in which always make the firſt and ſecond Term to be of one Denomination.

Example 1. If an Iron Bullet weigh 9 Pounds, and its Diamter be 4 Inches, what is the Weight of another Iron Bullet, whoſe Diameter is 6 Inches.

To perform this, the firſt and ſecond Terms are to be Lines, that is, the given Diameters; and then the Proportion is thus:

As 4 is to 6, ſo is 9 to 13.5; and ſo is 13.5 to 20.2, and ſo is 20.2 to 30.3; that is, 30 Pounds and 3 Tenths of a Pound, which is the Weight required.

That is, 1. By *Gunter* with Compaſſes, thus;

The Extent from 4 to 6 being laid three Times from 9, will reach to 30 Pounds 3 Tenths, the Weight required.

And, 2. By the *Sliding Gunter*, it is thus;

Set 4 againſt 6, and againſt 9 on the firſt is 13.5 on the ſecond; then againſt 13.5 on the firſt, is 20.2 on the ſecond; and againſt 20.2 on the firſt, is 30.3 on the ſecond, that is 30 Pounds 3 Tenths, as before.

Example 2. If an Iron Bullet 1 Inch Diameter, weigh Pounds 0.1406 Parts, what is the Weight of another whoſe Diameter is 4 Inches, it being of the ſame Metal? Anſwer, 9 Pounds. For,

As 1 is to 4, ſo is 0.1406 to 0.562; and ſo is 0.562 to 2.25; and ſo is 2.25 to 9 Pounds, the Weight required.

Example 3. If a Gun 6 Inches Bore require 11 Pounds of Powder, how much will ſerve a Gun 4 Inches Bore? Anſwer, Pounds 3.25 Parts.

For, As 6 is to 4, ſo is 11 to 7.3; and ſo is 7.3 to 4.88; and ſo is 4.88 to 3.25; which is Pounds 3.25 Parts of a Pound, or Pounds $3\frac{1}{4}$ of Powder.

Example 4. If an Iron Bullet 1 Inch Diameter weigh Pounds 0.1406 Parts, what ſhall the Diameter of that be, which weigheth 9 Pounds of the ſame Metal? Anſwer,

For it is thus: As 0.1406 is to 9, ſo is 1 to 64, the Cube of the Diameter required; then divide the Space between 1 and 64 into 3 equal Parts, and the Foot of the Compaſſes in the firſt $\frac{1}{3}$ Part from 1 reaching to 4, the Diameter of the Iron Shot weighing 9 Pounds.

II. *The Uſe of the Line of Numbers, commonly called* Gunter's Line, *in meaſuring Superficies, as Board, Glaſs-Land, &c.*

PROB. I. *The Length and Breadth of any Square, or Long-ſquare, Superficies being given, to find the Area or Content thereof.*

THE Proportion is this; As 1 is to the Breadth, ſo is the Length to the Content.

Example 1. A Plane Superficies, as a Board or Plank, being given to be meaſured, the Breadth thereof is 15 Inches, and its Length 61 Inches; what is the Content of it? Anſwer, 915 Inches.

For, as 1 is to 15, ſo is 61 to 915 Inches, the Content required.

Note, Such as the Breadth and Length are, ſuch is the Content; ſo that if the Breadth and Length be Feet, the Content is Feet; if Perches, then Perches, &c.

Example 2. A Piece of Wainſcot in Form of a long Square, whoſe Length is Feet 15.5 Tenths, and Breadth Feet 2.25 Hundredths; what is the Content? *Anſwer*, Feet 34.87 Hundredths. For as 1 is to 2.25 ſo is 15.5 to 34.87; that is, Feet 34 and 87 Hundredths the Content.

PROB. II. *The Breadth and Length of a Superficies being given in one Kind of Meaſure, to find the Content thereof in another Kind of Meaſure.*

THE Proportion is thus: As the Number contained in the Area of Unity in the required Kind of Meaſure, is to the Breadth; ſo is the Length to the Content deſired.

Example 3. A Plank or Board 15 Inches broad, 61 Inches long, I demand the Content of it in Feet? *Anſwer*, Feet 6.35 Hundredths of a Foot. For you muſt note in a Foot Superficial, or a Square Foot, is 144 ſquare Inches, and therefore the Proportion is thus: As 144 is to 15 Inches, ſo is 61 Inches to Feet 6.35 Parts of a Foot, the Content.

Example 4. A Piece of Land in Form of a Long Square, whoſe Breadth is 30 Poles, Length 183 Poles: What is the Content in Acres? *Anſwer*, Acres 34.31 Hundredths.

Note, 160 Poles is an Acre, and the Proportion is thus: As 160 Poles is to 30 Poles, ſo is 183 Poles to Acres 34.31 Hundredths of an Acre, the Content of the Piece of Land.

Example 5. A Piece of Painting in Form of a Long Square, whoſe Breadth in Feet is 3.5, and its Length 21 Feet, how many Square Yards is the Content? *Anſwer*, Yards 8.16 Hundredths of a Yard.

Note, 9 Feet is a Square Yard, and the Proportion is thus:

As 9 is to 3.5 Feet, ſo is 21 Feet to Yards 8.16 Hundredths of a Yard, the Content.

PROB. III. *The Breadth of a Superficies being given in one Kind of Meaſure, and the Length in another; to find the Content in the greater Meaſure.*

TO do this, the Proportion is thus: As ſo many of the leſs Kind of the given Meaſure, as is equal to the Length of one of the required Meaſure, is to the given leſs Meaſure, ſo is the given greater Meaſure, to the Content in the Meaſure required.

Example 6. Admit there be a Board of 10 Inches broad, and 20 Feet long, I demand the Content in Feet? *Anſwer*, Feet 16.6 Tenths of a Foot.

For the Proportion is thus: As 12 is to 10 Inches, ſo is 20 Feet to Feet 16.6 Tenths.

Example 7. If a Board or Plank be 15 Inches broad, and 27 Feet long, what is the Content of it in Feet? *Anſwer*, Feet 33.75 Parts of a Foot, or $33\frac{3}{4}$ Feet. For as 12 is to 15 Inches, ſo is 27 Feet to Feet 33.75 Parts.

Example 8. A Board $7\frac{1}{2}$ Inches broad, and $29\frac{1}{4}$ Feet long, what is the Content in Feet? *Anſwer*, Feet 18.28. For, it is as 12 is to $7\frac{5}{10}$; ſo is $29\frac{25}{100}$; to Feet 18.28 Parts.

Example 9. A Piece of Land in Form of a long Square, whoſe Breadth is 30 Perches, and Length in Chains 15.25 Links (meaſured by a Chain of 4 Perches in 100 Links) I demand the Content thereof in Acres? *Anſwer*, Acres 11.44. For it is, As 40 is to 30 Perches, ſo is Chains 15.25 to Acres 11.44 Parts of an Acre.

PROB. IV. *The Breadth of a Superficies being given to find how much in Length will make a Foot, a Yard, a Perch, or an Acre*, &c.

TO do this, take this general Rule: As the Breadth is to a Foot, a Yard, *&c.* ſo is a Foot, a Yard, *&c.* to that Length which will make a Foot, a Yard, *&c.*

Example 10. If a Board be $7\frac{1}{2}$ Inches broad, how much in Length will make a Foot ſquare? Anſwer, Inches 19.2 Tenths of an Inch.

For the Proportion is thus: As 7.5 is to 12, ſo is 12 to Inches 19.2 Tenths in Length, which will make a Foot.

Example 11. A Plank is 30 Inches broad, how much in Length will make a Foot? Anſwer, Inches 4.8 Tenths of an Inch.

For as 30 Inches is to 12, ſo is 12 Inches to 4.8 Tenths in Length to make a Foot.

Example 12. A Pane of Glaſs being in Breadth Feet 2.5 Tenths, how much in Length will make a Foot? Anſwer, 4 Tenths of a Foot. For it is thus;

As 2.5 is to 1 Foot, ſo is 1 Foot to 0.4 Tenths of a Foot in Length to make a Foot.

Example 13. A Piece of Matting being 27 Inches broad how much in Length will make a Yard ſquare? Anſwer 48 Inches, or 4 Feet. For it is thus;

As 27 Inches is to 36 Inches, ſo is 36 Inches to 48 Inches: But if the Breadth be given in Feet, that is, if for 27 Inches it be $2\frac{1}{4}$ Feet, or 2.25 Feet, then it is thus;

As 2.25 is to 3 Feet, ſo is 3 Feet to 4 Feet in Length, to make a Yard ſquare.

PROB. V. *The Diameter of a Circle being given, to find the Circumference.*

THE Analogy or Proportion is thus: As 1 is to 3.142 ſo is the Diameter to its Circumference.

Example 14. If the Diameter of a Circle be 15 Inches, what is the Circumference of it? Anſwer, Inches 47.13 Parts of an Inch.

For, as 1 is to 3.142, ſo is 15 Inches to Inches 47.13 Parts, the Circumference required.

PROB.

PROB. VI. *The Circumference of a Circle being given to find its Diameter.*

THE Proportion is this: As 3.142 is to 1, ſo is the Circumference to its Diameter.

Example 15. The Circumference of a Circle being 44 Feet, what is the Diameter thereof? *Anſwer* Feet 14, for it is,

As 3.142 is to 1, ſo is 44 Feet, to Feet 14 the Diameter.

PROB. VII. *The Diameter of a Circle being given, to find its Area, or ſuperficial Content.*

The Proportion is thus:

AS 1 is to the Diameter, ſo is 0.7854 to a fourth Number, and ſo is that fourth Number to the ſuperficial Content required.

Example 16. The Diameter of a Circle being 15 Inches, what is the Content of it? *Anſwer*, Inches 176.7 Tenths.

For it is, as 1 to 15, ſo is 0.7854 to 11.78; and ſo is 11.78 to 176.7 the ſuperficial Content required.

PROB. VIII *The Circumference of a Circle being given, to find the ſuperficial Content of it.*

The Proportion is thus:

AS 1 is to the Circumference, ſo is 0.07958 to a fourth Number, and ſo is that fourth Number to the ſuperficial Content required

Example 17. If the Circumference of a Circle be 44 Inches, what is the Content? *Anſwer*, Inches 154.06 Hundredths of an Inch. For it is,

As 1 is to 44, ſo is 0.7958 to 3.5; and ſo is 3.5 to Inches 154.06, the Content required.

III. *The Uſe of a Line of Numbers, in ſolid Meaſure, ſuch as Timber, Stone, Gauging, &c.*

PROB. I. *The Side of a Square Solid being given in Inches, to find how much in Length will make a Foot Solid.*

THE Proportion is thus: As the given Side is to 12, ſo is 12 to a fourth Number; and ſo is that fourth Number to the Length required to make a Foot Solid.

Example 1. A ſquare Piece of Timber or Stone, whoſe Breadth and Depth are each 8 Inches; how much in Length will make a Foot Solid? *Anſwer*, 27 Inches, or 2 Feet 3 Inches: For it is, as 8 is to 12, ſo is 12 to 18; and ſo is 18 to 27 Inches in Length, to make a Foot.

Example 2. A ſquare Piece of Timber or Stone, whoſe Side is 2 Feet or 24 Inches; how much in Length will make a Foot? *Anſwer*, 3 Inches. For it is, as 24 is to 12, ſo is 12 to 6; and ſo is 6 to 3 Inches in Length, to make a Foot Solid.

PROB. II. *The Side of a Square Solid given in Foot Meaſure, (that is, the Decimal Foot, or a Foot divided into 100 equal Parts) to find how much in Length will make a Foot Solid.*

THE Proportion is thus: As the given Side is to 1, ſo is 1 to a fourth Number; and ſo is that fourth Number to the Length required to make a Foot Solid.

Example 3. A ſquare Piece of Timber, whoſe Side is 1.52 Feet; how much in Length will make a Foot Solid? *Anſwer*, 0.432 of a Foot. For it is as 1.52 is to 1, ſo is 1 to 0.658; and ſo is 0.658 to 0.437 of a Foot.

PROB. III. *The Breadth and Depth of a Solid, whoſe two Ends are equal long Squares, (viz. Rectangles) being given in Inches, or in Foot Meaſure; to find how much in Length will make a Foot Solid.*

THE Proportion for Inches is thus: As 12 is to the Breadth, ſo is the Depth to a fourth Number: Then,

As that fourth Number is to 12, ſo is 12 to the Length in Inches to make a Foot Solid.

2. The Proportion for Foot-Meaſure is thus: As 1 is to the Breadth, ſo is the Depth to a fourth Number; and then, as that fourth Number is to 1, ſo is 1 to the Length in Foot-Meaſure, to make a Foot Solid.

Example 4. A Piece of Timber or Stone, whoſe Breadth is 11, and Depth 19 Inches; how much in Length will make a Foot? *Anſwer*, 8.27 Inches. For it is as 12 is to 11, ſo is 19 to 17.4: And then ſay, as 17.4 is to 12, ſo is to 12 to 8.27 Inches in Length, to make a Foot Solid.

Example 5. A Piece of Timber, in Breadth 0.75 Feet and Depth 1,25 Feet; how much in Length will make a Foot Solid? *Anſwer*, 1.06 Feet. For it is, as 1 is to 0.75, ſo is 1.25 to 0.94: Then ſay, as 0.94 is to 1, ſo is 1 to 1.06 Feet in Length, to make a Foot Solid.

PROB. IV. *The Side of a Square Solid, and its Length being given, to find the Content.*

1. WHEN the Side is given in Inches, and Length in Feet, the Proportion is thus: As 12 is to the given Side, ſo is the Length to a fourth Number; and ſo is that fourth Number to the Content in Feet.

When the Side and Length are both given in Foot-Meaſure, the Proportion is thus. As 1 is to the given Side; ſo is the Length to a fourth Number; and ſo is that fourth Number to the Content required.

Example 6. A Square Piece of Timber, whoſe Side is 9 Inches, and Length 35 Feet; how many Feet of Timber are in it? *Anſwer*, 19.68 Feet. For it is,

As 12 is to 9, ſo is 35 to 26.25; and ſo is 26.25 to 19.68 Feet, the Content required.

Example 7. A Piece of Timber 16 Inches ſquare, and 28 Feet long, how much is the Content? *Anſwer* 50 Feet.

For it is, as 12 is to 16, ſo is 28 to 37.3, and ſo is 37.3 to 49.8 Feet, the Content of the Piece of Timber.

Example 8. A Stone, 2.75 Feet Square, and 7.5 long, how much is the Content? *Anſwer* 56.72 Feet.

For it is, as 1 is to 2.75, ſo is 7.50 to 20.6; and ſo is 20.6 to 56.72 Feet, the Content required.

PROB. V. *The Length, Breadth, and Depth of a Square Solid being given, to find the Solid Content.*

1. IF the Breadth and Depth be given in Inches, and the Length in Feet, the Proportion is thus: As 12 is to the Breadth, ſo is the Depth to a fourth Number. Then ſay, As 12 is to that fourth Number, ſo is the Length in Feet to the Content in Feet.

2. When the Length, Breadth and Depth are all given in Foot-Meaſure, then the Proportion is thus: As 1 is to the Breadth, ſo is the Depth to a fourth Number: And then again ſay, As 1 is to that fourth Number, ſo is the Length to the Content in Feet.

Example 9. If a ſquare Piece of Timber be in Breadth 19 Inches, Depth 11 Inches, and 20 Feet long; how much is the Solid Content? *Anſwer*, 29.03 Feet.

For it is thus: As 12, is to 19; ſo is 11, to 17.4. Then ſay, as 12 is to 17.4 ſo is 20 to 29.03 Feet the Contents required.

Example 10. A Stone 20 Inches broad, 13 Inches deep, and Feet $15\frac{1}{4}$ or $15\frac{25}{100}$ Feet in Length; how much is the Content? *Anſwer*, 27.5 Feet.

For it is, as 12, is to 20; ſo is 13, to 21.67: And then as 21 is to 21.67; ſo is 15.25, to 27.5, that is $27\frac{1}{2}$ Feet is the Contents.

Example 11. A ſquare Piece of Timber, 1.25 Feet broad, Feet 0.56 deep, and 36 Feet long; how much is the Content? *Anſwer*, 25.2 Feet. For it is,

As 1, is to 1.25; ſo is 0.56, to 0.7; and then, ſay, as 1 is to 0.7; ſo is 36 to 25.2 Feet the Content required.

PROB. VI. *The Diameter of a Cylinder being given, to find how much in length will make a Foot Solid.*

1. IF the Diameter be given in Inches, the Proportion is thus: As the given Diameter is to 13.53; ſo is 12 to a fourth Number; and ſo is that fourth Number to the Length required to make a Foot Solid.

2. When the Diameter is given in Foot Meaſure, the Proportion is thus: As the given Diameter is to 1.128; ſo is 1 to a fourth Number, and ſo is that fourth Number to the Length, which will make a Foot Solid.

Example 12. A round Piece of Timber, or Stone, being 15 Inches Diameter; how much in Length will make a Foot Solid? *Anſwer*, 9.76 Inches. For it is

As 15 is to 13.531; ſo is 12 to 10.82, and ſo is 10.82 to 9.76 Inches: But ſuppoſing the Diameter of the ſame to be taken in Foot Meaſure, then the Queſtion is 1.25 Feet; and how much will make a Foot Solid? *Anſwer*, 0.81 of a Foot.

For it is thus: As 1.25, is to 1.28; ſo is 1 to 0.902; and ſo is 0.902, to 0.815 of a Foot to make a Solid Foot.

PROB. VII. *The Circumference of a Cylinder being given, to find how much in Length will make a Foot Solid.*

1. WHEN the Circumference is given in Inches, the Proportion is,

As the Circumference is to 42.54, ſo is 12 to a fourth Number, and ſo is that fourth Number to the Length required to make a Foot Solid.

2. But if the Circumference be given in Foot Meaſure, then the Proportion is,

As the Circumference is to 3.545, ſo is 1 to a fourth Number; and ſo is that fourth Number to the Length, to make a Foot Solid.

Example 13. If a round Stone or Tree, be 44 Inches about, how much in Length will make a Foot? *Anſwer*, 11.22 Inches. For it is,

As 44 is to 42.54, ſo is 12 to 11.6; and ſo is 11.6 to 11.22 Inches

But ſuppoſe the ſame was meaſured by Foot-Meaſure and the Circumference found to be 3.67 Feet, how much in Length will make a Foot? *Anſwer*, 0.933 Parts, for it it thus;

As 3.67, is to 3.545; ſo is 1, to 0.966; and ſo is 0.966 0.933 of a Foot.

PROB. VIII. *The Diameter and Length of a Cylinder being given, to find the Solid Content.*

1. WHEN the Diameter is given in Inches, and Length in Feet, the Proportion is thus;

As 13.531 is to the Diameter, ſo is the Length to a fourth Number; and ſo is that fourth Number to the Solid Content in Feet.

2. If the Diameter and Length are both given in Foot-Meaſure, then the Proportion is thus;

As 1.128 is to the Diameter, ſo is the Length to a fourth Number; and ſo is that fourth Number to the Content required.

Example 14. A round Piece of Timber 10 Inches thro' and 30 Feet long; how many Feet of Timber are in it? *Anſwer*, 16.38 Feet. For it is, as 13.531 is to 10, ſo is 30, to 22.16; and ſo is 22.16, to 16.38 Feet.

But ſuppoſe the ſame Piece is meaſured by Foot Meaſure, 0.83 of a Foot through, then the Work is thus:

As 1.128 is to 83, or 0.83, ſo is 30 to 22.16; and ſo is 22.16 to 16.38 Feet, as before.

PROB. IX. *The Circumference and Length of a Cylinder, being given, to find the Solid Content.*

1. IF the Circumference be given in Inches, and the Length in Feet, the Proportion is thus: As 42.54 is to the Circumference, ſo is the Length to a fourth Number; and ſo is hat fourth Number to the Solid Content in Feet.

2. When the Circumference and Length are both given in Foot-Meaſure, if the firſt Term be made 3.545 (inſtead of 42.54) the former Words will ſerve.

Example 15. A round Stone or Tree, being 30 Inches about, and 25 Feet long, how many Feet Solid are in it? *Anſwer*, 12.43 Feet. For it is thus: As 42.54 is to 30, ſo is 25 to 17.63; and ſo is 17.63 to 12.43 Feet.

Now the Compaſs about being taken in Foot-Meaſure is 2.5 Feet, and the Proportion is, as 3.545 is to 2.50, ſo is 25 to 17.63; and ſo is 17.63 to 12.43 Feet as above.

Note, When Timber tapers, that is, bigger at one End than at the other, it is cuſtomary to take the Breadth and Depth in the Middle of its Length, and by them to meaſure the Pieces as if both Ends were of a Bigneſs.

Note 2. The Proportions for Foot Meaſures are the ſame when all the Dimenſions are taken in Inches; only the Solid Content found is Inches.

Note 3. The Solid Content in Inches divided by 1728, the Quotient is Feet; but if divided by 282, or 231, the firſt is Beer, the latter Wine Gallons; and how to divide by the Line of Numbers was ſhewn in Problem IV. of the firſt Uſes of the Gunter.

PROB. X. *The Diameter of a Caſk at the Head and Bung, and alſo in Length being given in Inches, to find its Content in Gallons, Beer, or Wine.*

The RULE is thus:

1. AS 1 is to 0.7, ſo is the Difference of the Bung and Head Diameter, to a fourth Number, which being added to the Head Diameter, the Sum is a mean Diameter, reducing the Caſk to a Cylinder. Then ſay;

2. As the Gage Point (which for Beer or Ale is 18.95, but for Wine 17.15) is to the mean Diameter, ſo is the Length, to a fourth Number; and ſo is this fourth Number, to the Content in Gallons required.

Example. 16. Suppoſe a Caſk whoſe Length is 40

$$\text{The Diameter at the - - - - - - - -}\left\{\begin{array}{l}\text{Bung } 28\\ \text{Head } 20\end{array}\right\}\text{Inch}$$

What is its Content in Gallons, Beer, or Wine?

Anſwer, 73 Gallons Beer, and Wine Gallons 89.1 Tenth.

Bung Diameter - - - - - - - - - 28 Inches
Head Diameter - - - - - - - - - 20 Inches

Their Difference - - - - - - - 8 Inches

Then as 1, is to 0.7; ſo is 8, to 5.6; which added to 20, the Head Diameter, makes 25.6 for the mean Diameter: Then ſay,

$$\text{As}\left\{\begin{array}{l}18.95\\ 17.15\end{array}\right\}\text{is to } 25.6\text{; ſo is } 40\text{, to}\left\{\begin{array}{l}54\\ 59.71\end{array}\right\}\text{and ſo is}$$

$$\left\{\begin{array}{l}54\\ 59.71\end{array}\right\}\text{to}\left\{\begin{array}{l}73 \text{ Beer}\\ 89.12 \text{ Wine}\end{array}\right\}\text{Gallons.}$$

1. By *Gunter* with Compaſſes, thus;

1. The Extent from 1 to 0.7 will reach the ſame Way from 8 to 5.6; which being added to 20; the Head Diameter, make 25.6 for the mean Diameter: Then

2. The Extent from 18.95 (the Gauge Point of Beer) to 25.6 will reach from 40, to 54; and that Extent turned over again reaches to 73, the Content in Beer Gallons.

In like Manner the Extent from 17.15 (the Gauge Point of Wine) to 25.6, being laid twice from 40, will reach to 89.12 the Wine Gallons.

2. By the *Sliding Gunter*, thus;

1. Set 1 againſt 0.7, and againſt 8 on the Firſt, is 5.6 on the Second; which added to 20 (the Head Diameter) makes 25.6 for the mean Diameter: Then

2. Set 18.95 (the Gauge Point for Beer) on the Firſt, againſt 25.6 on the Second; then againſt 40 on the Firſt, is 54 on the Second, the Content in Beer Gallons.

Alſo, if you ſet the Gauge Point for Wine 17.15 againſt the mean Diameter 25.6, then againſt the Length of the Caſk 40 on the Firſt, you will find 59.71 on the Second; and againſt 59.71 on the Firſt, will be had on the Second 89.12 the Content in Wine Gallons.

PROB. XI. *The Length of a Ship's Keel and Breadth at the Beam being given to find her Tonnage.*

IT is the Practice of Shipwrights about *London*, to multiply the Length of the Keel, and Breadth and Half Breadth at the Beam, into one another, and to divide the laſt Product by 94, whoſe Quotient they count for the Ship's Tonage; from whence I frame the following Proportions to be wrought by the Line of Numbers.

1. As 188 is to the Breadth, ſo is the Breadth to a fourth Number. Then ſay,

2. As 1 is to that fourth Number, ſo is the Length to the Tonnage required.

Example 17. Suppoſe a Ship 72 Feet by the Keel, and 24 Feet by the Beam: I demand her Tonnage? *Anſwer*, 220.6 Tons neareſt. See the following Work;

As 188 is to 24, ſo is 24 to 3.06, and then,

As 1 is to 3.06, ſo is 72 to 220.6 Tons.

1. By *Gunter* with Compaſſes, thus;

1. The Extent from the given Number 188, to the Breadth of the Beam 24, will reach from (the ſaid Breadth) 24 to 3.06. Then,

The Extent from 1 to 3.06, will reach from the Length of the Keel 72, to 220.3 Tons, the Tonnage required.

Or more briefly thus: The Extent from 13.71 (which is the Square Root of the given Number 188) to the Breadth of the Beam 24, being turned over twice from the Length of the Keel 72, reacheth to 220.3 Tons as before.

2. By the *Sliding Gunter*, thus;

1. Set the given Number 188, againſt the Breadth of the Ship 24, then againſt the ſaid Breadth 24 on the firſt is 3.06 on the ſeconed: Then,

2. Set 1 againſt 3.06, and againſt the Length of the Keel 72 on the firſt, is 220.3 Tons on the ſecond, as before.

PROB. XII. *To find the Tonnage of a Box, Bale or Caſe, having its Length, Breadth and Depth given.*

The RULE is thus;

1. As 66 is to the Breadth, ſo is the Depth to a fourth Number: Then,

2. As 1 is to that fourth Number, ſo is the Length to its Tonnage required.

Example 18. A Caſe or Bale being 6 Feet broad, 4 Feet deep, and 10 Feet long, I demand its Tonnage? *Anſwer*, 3.6 Tons. For it is thus;

1. By *Gunter's Scale* with Compaſſes.

1. The Extent from the given Number 66 to the Breadth 6, reacheth from the Depth 4 to 0.363: Then,

2. The Extent from 1 to the laſt found Number 0.363 being laid from the Length 10, reacheth to 3.63; that is 3.63 Tons, or ſomewhat more than 3½ Tons.

By the *Sliding Gunter*, thus;

1. Set the given Number 66, againſt the Breadth of the Bale or Caſe 6; then againſt the Depth of it 4 on the firſt, you will find 0.363 on the ſecond, a fourth proportional Number: Then,

2. Set 1 againſt the ſaid Proportional Number 0.363; and againſt the Length of the Bale or Caſe 10 on the firſt, will be found on the ſecond, 3.63, or $3\frac{63}{100}$, the Tonnage of the Bale or Caſe propoſed.

Note; That 66 Feet is the Content of a Caſe that will incloſe two *Engliſh* Butts, but the Cantlings of them are better than a third Part; therefore allowing 26 Feet for the Cantlings, the remaining 40 Feet are counted 1 Ton. And the Rule is,

1. By the *Gunter* with Compaſſes, for the aforeſaid *Examp.*

1. The Extent from the given Number 40, to the Breadth of the Caſe or Bale 6, will reach from the Depth 4 to 0.6, a fourth Proportional Number: Then,

2. The Extent from 1, to the ſaid fourth Number 0.6, will reach the ſame Way, from the Length 10, to 6 Tons, the Content of the Caſe or Bale required.

2. By the *Sliding Gunter*, thus;

1. Set the given Number 40, againſt the Breadth of the Bale or Caſe 6, then againſt the Depth of it 4, on the firſt, is 0.6 on the Second, a fourth Proportional Number: Then,

2. Set 1 againſt the ſaid Proportional Number 0.6, and againſt the Length of the Bale or Caſe 10 on the Firſt, you will find on the Second 6, the Tonnage of the Bale or Caſe propoſed.

PBOB. XIII. *The Diameter of a Globe being given, to find the Solid Content.*

The RULE.

AS 1, is to the Diameter; ſo is 0.5236, to a fourth Number; and ſo is that fourth Number to a fifth; and ſo is this fifth, to its ſolid Content required.

Example 19. A Globe whoſe Diameter is 8 Inches, what is the ſolid Content? *Anſwer*, 268 Inches. For it is

As 1 is to 8, ſo is 0.5236, to 4.19; and ſo is 4.19, to 33.5; and ſo is 33.5, to 268 Inches the ſolid Content of the Globe.

IV.

IV. *The Uſe of the Line of Numbers in Gunnery.*

PROB. I. *The Diameter and Weight of any Piece of Ordnance being known, to find the Weight of any other, being of the ſame Metal and Shape, and its Diameter known.*

Like Solids are in Proportion, as the Cubes of their homologous Sides. Therefore the Rule is thus:

AS the Diameter of the known Gun, is to the Diameter of the Gun whoſe Weight is required; ſo is the Weight of the known Gun, to a fourth Number, and ſo is that fourth to a fifth; and ſo is that fifth to the Weight required.

Example 1. Suppoſe a Braſs Saker, whoſe Diameter is 11.5 Inches, and Weight 1900 Pounds; what will a Braſs Gun weigh, whoſe Diameter is 8.75 Inches? *Anſwer* 837.5 Pounds. For it is thus:

1. By *Gunter's Scale* with Compaſſes,

The Extent from the Diameter 11.5 to the Diameter 8.75, being laid three Times from the Weight 1900, will reach to 837.5 Pounds, the Weight of the Gun required. And,

2. By the *Sliding Gunter*,

Set the Diameter 11.5, againſt the Diameter 8.75, then againſt the Weight 1900 on the Firſt, is 1445 on the Second; and againſt 1445 on the Firſt, is 1100 on the Second. Alſo againſt 1100 on the Firſt, is 837.5 Pounds, the Weight required, on the Second.

PROB. II. *Having the Diameter and Weight of one Piece of Ordnance, and the Diameter of another Piece of another Metal given; to find the Weight of the laſt, it being of the ſame Shape with the former.*

The RULE is thus;

1. FIND the Weight of the Piece as if it had been of the ſame Metal as the propounded Piece by the laſt Problem: Then,

2. Conſider the Proportional Weights of Metals, which are known by the following Table of ſpecific Gravity, eſtimated from the lateſt and moſt approved Experiments.

Caſt Lead is to	Caſt Braſs	as 11.26 is to	8.208
	Caſt Iron		7.135
	Marble		2.7
	Flint Stone		2.621

Caſt Iron is to	Caſt Braſs	as 7.135 is to	8.208
	Marble		2.7
	Flint Stone		2.621

The Specific Gravity of *Engliſh* Pebble is 2.696, which is heavier than Flint Stone, and very near the Weight of Marble; Pebble Stone is 2.601; *Portland* Stone 2.57, and Common Stone 2.5.

3. Having the Weights of both Pieces in one Sort of Metal, you muſt then Proportion their Weight according to their different Metals, by the Proportional Numbers of thoſe Metals, and then it is done.

Example 2. If a Braſs Saker of 11.5 Inches Diameter, weigh 1900 Pounds; what will an Iron Gun (of the ſame Shape) weigh, whoſe Diameter is 8.75 Inches? *Anſwer*, 728 Pounds. The Operation is thus:

1. I find by Prob. I. 8.75 Inches, that a Braſs Piece of 8.75 Inches Diameter, will weigh 837.5 Pounds; but becauſe this Piece is Iron, and the Proportion of Braſs to Iron (as aboveſaid) is as 8.208 is to 7.135; therefore ſay,

2. As 8,208 is to 7.135, ſo is 837.5 to 728 Pounds, the Weight of the Iron Gun required.

PROB. III. ***By knowing the Allowance of Powder for one Gun, to find how much of the ſame Powder is requiſite for another Gun.***

The RULE.

AS the Diameter of the Bore of the Gun, whoſe Allowance is known, is to the Diameter of the Gun whoſe Allowance is required; ſo is the Allowance given, to a fourth Number, and ſo is that fourth, to a fifth, and ſo is the fifth, to the Allowance required.

But note; here it is underſtood that both Guns are alike fortified, that is, that they ſhall have the ſame Proportion in Weight and Thickneſs of Metal.

Example 3. If a Saker of 3.5 Inches Bore require 4 Pounds of Powder, what will a Demi-Cannon of 6.5 Inches Bore require? *Anſwer*, 25.62 Pounds. For it is thus:

As 3.5 is to 6.5, ſo is 4 to 7.44; and ſo is 7.44 to 13.80; and ſo is 13.80 to 25.62 Pounds the Weight of Powder for the Demi-Cannon, in Proportion to the given Saker. But ſuppoſe the Weight of the Saker to be 1600, and the Weight of the Demi-Cannon 6000; what Allowance of Powder muſt it then have?

I. By Problem I. Find the Weight, of the Demi-Cannon in Proportion to the Saker's Weight, which is thus:

1. As 3.5 is to 6.5, ſo is 1600 to 1297; and ſo is 2971 to 5517, and ſo is 5517 to 10246 Pounds, the Weight of the Demi-Cannon, requiring Pounds 25.62 Parts of Powder for its Loading. But ſeeing its Weight is ſuppoſed to be 6000, ſay,

2. As 10246 is to 6000, ſo is 25.62 to 15 Pounds, the due Allowance of Powder for the Demi-Cannon of 6.5 Inches Bore, weighing 6000 Pounds, at the Rate of a Saker 3.5 Inches Bore, weighing 1600 Pounds, and requiring four Pounds of Powder.

PROB. IV. *Having the Diameter and Weight of one Bullet, and the Diameter of another Bullet given, to find the Weight of the latter.*

The RULE.

THE Weight of Bullets (of the ſame Metal) are in Triplicate Proportion of their Diameters, and wrought by the Directions in Problem X. of the firſt Uſes of the *Gunter*.

Example 4. If an Iron Bullet 4 Inches Diameter weigh 9 Pounds; what will an Iron Bullet of 6 Inches Diameter weigh? *Anſwer*, 30.375 Pounds. For it is thus;

As 4 is to 6, ſo is 9, to 13.5, and ſo is 13.5 to 20.25; and ſo is 20.25 to 30.375 Pounds.

PROB. V. *Two Bullets, equal in Diameter, but of different Metals; by the Diameter and Weight of the one, to find the Weight of the other.*

1. AS the Proportion of one Metal is to the other, ſo is the Weight of the given Bullet to the Weight of the Bullet required.

Example 5. Suppoſe an Iron Bullet of 6 Inches Diameter, weigh 30.375 Pounds; what will a Flint Stone Bullet of the ſame Diameter weigh? *Anſwer*, 11.158 Pounds. The Operation is thus;

By Problem II. of Gunnery the Proportion of Iron to Flint Stone is as 7.135 is to 2.621: therefore it is,

As 7.135 is to 2.621, ſo is 30.375 to 11.158 Pounds, the Weight of the Stone Bullet.

PROB. VI. *Having the Diameter and Weight of a Bullet of one kind of Metal, and the Diameter of any Bullet of any other given, to find the Weight of the latter.*

The RULE.

1. FIND the Weight of it (by Problem IV.) as if it was the ſame Metal.

2. Then find its Weight according to the Proportion of the Metals by the laſt *Problem*, and it is done.

Example 6. If an Iron Bullet 4 Inches Diameter, weigh 9 Pounds; what is the Weight of a Leaden Bullet 6 Inches Diameter? *Anſwer*, 47.93 Pounds; according to the following Operation:

1. As 4 is to 6, ſo is 9 to 13.5; and ſo is 13.5 to 20.25; and ſo is 20.25 to 30.375 Pounds, if it had been Iron, but as it is Lead, ſay,

2. As 7.135 is to 11.26, ſo is 30.375 to 47.93 Pounds the Weight, being Lead.

V. *The Uſe of* Gunter's Scale *in* Navigation; *firſt in* Plane Sailing.

CASE I.

The Courſe and Diſtance ſailed being given; to find the Difference of Latitude and Departure from the Meridian.

To do this, the Proportions are theſe:

AS Radius is to the Diſtance, ſo is the Sine of the Courſe to the Departure from the Merdian.

2. As Radius is to the Diſtance, ſo is the Sine Complement of the Courſe to the Difference of Latitude.

Note, The Radius according to the Nature of the Proportion, may be any of theſe.

8 Points	on the Line of	Sine Rhumbs.
4 Points		Tangent Rhumbs.
90 Degrees		Sines.
45 Degrees		Tangents.

And for Conveniency, that each Proportion may ſtand in one Line.

Let S.	ſtand for	Sine
S. c.		Sine Complement
T.		Tangent
T c.		Tangent Complement
Crs.		Courſe
Diſt.		Diſtance ſailed
Diff. Lat.		Difference of Latitude
Dep.		Depart. from the Meridian.

Example. If a Ship Sails SW. by S. 104 Minutes from Latitude 1d. 45m. North, I demand what Latitude ſhe is in, and her Departure from the Meridian?

As S.8P.is to 104M.ſo is S. $\begin{Bmatrix}3\\5\end{Bmatrix}$ Points to $\begin{Bmatrix}\text{Dep. } 58M.\\ \text{Diff. Lat. } 86M.\end{Bmatrix}$

1. By *Gunter* with Compaſſes, thus;

The Extent from 8 Points on the Line of Sine Rhumbs, to 104 Min. (on the Line of Numbers) will reach the ſame Way from 3 Points (on the Line of Sine Rhumbs) to 58m. (on the Line of Numbers) which is the Departure from the Meridian; and the Compaſſes kept at the ſame Diſtance, will reach (the ſame Way) from 5 Points (on the Line of Sine Rhumbs) to 86 Minutes (on the Line of Numbers) which is the Difference of Latitude.

Note; The Courſe is 3 Points, becauſe SW. by S. is 3 Points from the Meridian or South; and 5 Points is the Complement of the Courſe, becauſe S.W by S. is 5 Points from the Parallel or Weſt; underſtand the like in any other Courſe.

By the Sliding Gunter, thus:

Slide 104 min. on the Middle Piece, againſt 8 Points, on the Line of Sine Rumbs, on the lower outſide Piece; then againſt 3 Points on the firſt, is 57¾ Minutes on the ſecond, the Departure from the Meridian, and againſt 5 Points on the firſt, is 86 Minutes on the ſecond, the Difſerence of the Latitude.

	D.	M.	
Latitude ſailed from - - - - - - - -	1 :	45	North
Difference of Latitude 86 Minutes, or	1 :	26	South
Subtract gives the Latitude required- -	0 :	19	North

CASE II.

The Courſe and Difference of Latitude being given, to find the Diſtance ſailed, and the Departure from the Meridian.

To do this, the Proportions are theſe:

1. As the Sine Comp. of the Courſe is to the Difference of Latitude, ſo is Radius to the Diſtance run.

2. As the Sine Complement of the Courſe is to the Difference of Latitude, ſo is the Sine of the Courſe to the Departure from the Meridian.

Example. Suppoſe a Ship ſails N. N. E. from the Latitude of 2d. 15m. South, and then by Obſervation is in Latitude 1d. 22m. North; what is her Diſtance ſailed and Departure from the Meridian?

	D.	M.	
Latitude ſailed from - - - - - - - - -	2 :	15	South
Latitude by Obſervation - - - - - - -	1 :	22	North

Added, gives the Difference of Latitude 3 : 37 which reduced into Minutes by multiplying by 60, is 217 Min. Then,

As S. 6 Pts, is to 217 M. ſo is S. $\left\{\begin{matrix}8\\2\end{matrix}\right\}$ Pts. to $\left\{\begin{matrix}235 \text{ the Diſt.}\\90 \text{ the Dep.}\end{matrix}\right.$

CASE

CASE III.

The Courſe and Departure from the Meridian being given, to find the Diſtance run, and the Difference of Latitude.

This is performed by theſe Proportions.

1. As the Sine of the Courſe is to the Departure from the Meridian, ſo is Radius to the Diſtance ſailed.

2. As the Sine of the Courſe is to the Departure from the Meridian, ſo is the Sine Complement of the Courſe to the Difference of Latitude.

Example. If a Ship ſails SE by E. from 1d. 10m. North Latitude, till her Departure be 92 Minutes, what is her Diſtance ſailed, and Latitude ſhe is in?

As S. 5 Pts. is to 92 M. ſo is S. $\left\{\begin{matrix}8\\3\end{matrix}\right\}$ Pts. to $\left\{\begin{matrix}\text{110 Diſt.}\\\text{61 Diff L.}\end{matrix}\right.$

	D.	M.	
Latitude ſailed from - - - - - - - -	1 :	10	North
Difference of Latitude 61 Minutes. or -	1 :	1	South
Subtracted, gives the Latitude the Ship is in	0 :	9	North

CASE IV.

The Diſtance run, and Difference of Latitude being given, to find the Courſe and Departure from the Meridian.

The Proportions are theſe:

1. AS the Diſtance ſailed is to the Radius, ſo is the Difference of Latitude to the Sine Complement of the Courſe.

2. As the Radius is to the Diſtance ſailed, ſo is the Sine of the Courſe to the Departure from the Meridian.

Example. Admit a Ship ſails between the S. and W. 98 Leagues from the *Lizard*, in 49d. 57m. North Latitude, and then by Obſervation is in 46d. 27m. North Latitude, what is her Courſe and Departure from the Meridian?

D. M.
Latitude ſailed from ———————— 49 : 57 North
Latitude by Obſervation ———————— 46 : 27 North

The Difference of Latitude - - - - 3 : 30 or 70 L.

1. As 98 Leagues, is to Sine of 90 Degrees, ſo is 70 Leagues to Sine 45d. 30m. whoſe Complement 44d. 30m. is the Courſe from the South Weſtward, that is, South Weſt neareſt: Then,

2. As Sine 90 Degrees is to 98 Leagues, ſo is Sine 44d. 30m. to 68.4 Leagues, the Departure from the Meridian.

1. By *Gunter* with Compaſſes.

1. The Extent from 98 Leag. on the Line of Numbers, to 90 Degrees on the Line of Sines, will reach the ſame Way from 70 Leag. on the Line of Numbers, to 45 Deg. 30 Min. on the Line of Sines; which being ſubtracted from 90 Deg. leaves 44d. 30m. for the Courſe.

2. The Extent from 90 Degrees on the Line of Sines, to 98 Leagues, on the Line of Numbers, will reach from 44d. 30m. on the Line of Sines, to 68.4 Leagues, on the Line of Numbers, which is the Departure from the Meridian.

2. By the *Sliding Gunter*.

1. Bring 98 Leagues on the Line of Numbers on the middle Piece, againſt 90 Degrees on Line of Sines, on the out-ſide Piece; then right againſt 70 Leagues on he Firſt, is 45 Deg. 30 Min. on the Second, which is the Complement of the Courſe, and ſubtracted from 90 Deg. gives 44d. 30m. which is near four Points from the South towards the Weſt, or South Weſt.

2. And as it now ſtands, againſt 44d. 30m in the Line of Sines on the outſide Piece, is 68.4 Leagues in the Line of Numbers, on the middle Piece, which is the Departure from the Meridian. Or ſet 98 on the Line of Numbers to 8 Points on the Sine Rhumbs; then againſt 70 Leagues on the firſt is 4 Points, and ſomewhat more for the Complement of the Courſe as above.

CASE V.

The Diſtance run, and the Departure from the Meridian being given, to find the Courſe and Difference of Latitude.

The Proportions are as follow:

1. AS the Diſtance ſailed is to Radius; ſo is the Departure from the Meridian, to the Sine of the Courſe.

2. As Radius, is to the Diſtance ſailed, ſo is the Sine Complement of the Courſe, to the Difference of Latitude.

Example. A Ship ſails 354 Minutes between the North and Eaſt from 1d. 19m. South Latitude, until her Departure from the Meridian be 150m. what is her Courſe, and what Latitude is ſhe in?

1. As 354 Minutes is to Sine 90d. ſo is 150 Minutes to Sine 25d. ſo that the Courſe is N. Eaſtward, or NNE. a quarter Eaſt.

2. As S. 90. Degrees is to 354 Minutes, ſo is Sine 65 Degrees, to 323 Minutes, the Difference of Latitude.

	D. M.	
Latitude ſailed from is - - - - - -	1 : 19	South
The Difference of Lat. 323 Minutes, or	5 : 23	North
Subtracted, gives the Latitude the Ship is in	4 : 4	North

ſo that the Ship hath croſſed the Equator.

CASE VI.

The Difference of Latitude and Departure from the Meridian being given, to find the Courſe and Diſtance run.

To do this, theſe are the Proportions:

1. AS the Difference of Latitude is to the Departure from the Meridian, ſo is Radius, to the Tangent of the Courſe.

2. As the Sine of the Courſe is to the Departure from the Meridian, ſo is Radius to the Diſtance ſailed.

Example. Sailing between the North and Weſt, from a Port in 1d. 59m. South Latitude, and then arriving at another Port which is in 3d. 8m. North Latitude, and 209 Minutes to the Weſtwad of the firſt Port. I demand the Courſe and Diſtance from the firſt Port to the ſecond.

D. M

	D.	M.
Latitude of the firſt Port - - - - - -	1 :	59 South
Latitude of the ſecond Port- - - - -	3 :	8 North
Added, gives the Difference of Latitude	5 :	7 or 307m.

1. As 307 Min. is to 209 Min. ſo is Tangent 45 Deg. to Tangent 34 Deg. 15 Min. the Courſe North Weſtward, or NW. by N. neareſt.

2. As S. 34 Degrees 15 Minutes, is to 209 Minutes, ſo is S. 90 Degrees to 307 Minutes, the Diſtance between the two Ports.

1. By *Gunter* with Compaſſes, thus:

1. The Extent from 307 Min. to 209 Min. on the Line of Numbers will reach from 45 Deg. on the Line of Tangents (that now being the Radius) to 34 Degrees 15 Min. on the ſame Line of Tangents, which is the Courſe from the Meridian.

Note, When the Difference of Latitude is greateſt, the Courſe is leſs than 45 Degrees from the Meridian.

But when the Departure from the Meridian is greateſt, the Courſe is more than 45 Degrees from the Meridian.

2. The ſecond Canon or Proportion for the Diſtance run, is wrought as in the ſecond and third Caſe, in Pages 210 and 211.

2. By the *Sliding Gunter*, thus;

1. In this Caſe place the middle Piece in ſuch a Manner, that a Tangent Line may ſlide againſt a Tangent Line, and alſo Numbers againſt Numbers: Then bring 307 Min. on the Line of Numbers on the middle Piece, againſt 209 Min. on the Line of Numbers on the outſide Piece, and againſt 45 Degrees on the Line of Tangents, on the middle Piece, on the other ſide the Sliding Gunter, will be 34 Degrees 15 Minutes on the Tangents on the out ſide Piece, which is the Courſe required.

2. For the Diſtance, the Manner of working is the ſame as has been ſhewn in Caſes Firſt, Second, and Third.

To

To reſolve a Traverſe by *Gunter's* Scale.

Example 1. A Ship in 40 Degrees North Latitude, and 5 Degrees 14 Minutes Weſt Longitude, ſails firſt S. E. by S. 68 Minutes, then S. W. by W. 55 Minutes, and then W. N. W. 75 Minutes: I demand the Courſe and Diſtance from the firſt Place of Departure, and what Latitude and Longitude ſhe is in?

To do this, Firſt find the Difference of Latitude and Departure from the Meridian, for each ſeveral Courſe as directed in Caſe I. of Plain Sailing.

2. Collect the ſeveral Differences of Latitude into two Sums, *viz.* the Northing into one, and the Southing into another, and in like Manner, the ſeveral Departures either Eaſt or Weſt, taking the Difference of the Northing and Southing, for the Difference of Latitude, and the Difference of the Eaſting and Weſting for the Departure from the Meridian.

3. Having now the Difference of Latitude and the Departure from the Meridian known, the Courſe and Diſtance may be found in the Sixth Caſe of Plain Sailing.

4. The Difference of Longitude may be found by this Proportion.

As the Sine Complement of the Middle Latitude is to the Departure from the Meridian, ſo is Radius to the Difference of Longitude. See the Work following.

$$\text{1. Courſe, as S. 8 Pts. is to 68, ſo is S.}\left\{\begin{array}{l}\text{3 to 37.8 E.ing}\\\text{5 to 56.5 S.ing}\end{array}\right.$$

$$\text{2. Courſe, as S. 8 Pts. is to 55, ſo is S.}\left\{\begin{array}{l}\text{5 to 45.7 W.ing}\\\text{3 to 30.6 S.ing}\end{array}\right.$$

$$\text{3. Courſe, as S. 8 Pts. is to 75, ſo is S.}\left\{\begin{array}{l}\text{6 to 69.3 W.ing}\\\text{2 to 28.7 N.ing}\end{array}\right.$$

Courſe

	Courſes.	Diſt.	Diff. Lat.		Departure.	
			North	South	Eaſt	Weſt
1.	S.E. by S.	68		56.5	37.8	
2.	S.W. by W.	55		30.6		45.7
3.	W.N.W.	75	28.7			69.3
			28.7	87.1 28.7	37.8	115.0 37.8
		Diff. Lat.		58.4		77.2 D

3. Then; as Min. 58.4 is to Min. 77.2, ſo is T. 45d. to T. 53d. nearly the Courſe from the South towards the Weſt, that is, S. W. three quarters W. nearly; And again,

As S. 53 is to min. 77.2. ſo is S. 90d. to 96.8 Minutes, nearly the Diſtance from the firſt Place of Departure.

D. M.
Latitude ſailed from ———————— 40 : 00 North;
The Diff. of Latitude min. 58.4 or — 0 : 58 Southerly

Subtracted, gives the Lat. the Ship is in 39 : 2 North;

Therefore the middle Latitude is * — 39 : 31
Subtracted from ———————— 90 : 0

Gives the Comp. of the middle Lat. 50 : 29

4. As S. 50d. 29m. is to Min. 77.2, ſo is S. 90d. to 101.1m. the Difference of Longitude.

D. M.
The Longitude ſailed from is ——— 5 : 14 Weſt.
The Difference of Longitude ——— 1 : 41 Weſt.

Added, gives the Longit. the Ship is in 6 : 55 Weſt.

Example 2. A Ship in 41d. 30m. North Latitude, and 10d. 20m. Eaſt Longitude, ſails theſe ſeveral Courſes and Diſtances, viz. S. E. by S. 52 Minutes, then S.S.W. 63 min.

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* The middle Latitude is thus found; to the Latitude ſailed from, add the Latitude come to; and take half the Sum for the middle Latitude.

63 Minutes, E. by N. 47 Minutes, N. by E. half E. 35 Minutes, NNW. a quarter W. 47 Min. WNW. 73 Min. I demand the Courſe and Diſtance from the firſt Place of Departure, alſo the Latitude and Longitude the Ship is in?

1. For the doing of which, obſerve the following Work.

		M.		Points.		M.
1	Courſe, as S. 8 Pts. is to	52	ſo is S	3 5	to	28.9 E. 43.2 S.
2		63		2 6		24.1 W 58.2 S.
3		47		7 1		46.1 E. 9.2 N.
4		35		1½ 6½		10.2 E. 33.5 N.
5		47		2¼ 5¾		20.1 W 42.5 N.
6		73		6 2		67.4 W 27.9 N.

2. Then, to collect the ſeveral Northings, Southings, Eaſtings, and Weſtings into one, ſee the following Table; whereby you have the Difference of Latitude and Departure from the Meridian.

	Courſes.	Diſt	Diff. Lat.		Departure	
			North	South	Eaſt	Weſt
1.	S. E. by S.	52		43.2	28.9	
2.	S. S. W.	63		58.2		24.1
3.	Eaſt by North	47	9.2		46.1	
4.	N. by E. ½ E.	35	33.5		10.2	
5.	N. N. W. ¼ W.	47	42.5			20.1
6.	W. N.W.	73	27.9			67.4
			113.1	101.4	85.2	111.6
			101.4			85.2
	Difference Latitude		11.7	Departure		26.4

3. Now, having the Difference of Latitude and Departure from the Meridian known, the direct Courſe and Diſtance is thus found :

As 11.7 Minutes is to 26.4 Minutes, ſo is T. 45d. to T. 66d. 6m. the Courſe North Weſterly, or W. N. W. becauſe the North and Weſt Columns are the greateſt.

Here obſerve the Courſe is more than 45 Degrees from the Meridian, becauſe the Departure is more than the Difference of Latitude, according to the Note in the 6th Caſe of Plain Sailing. Then for the Diſtance, ſay,

As S. 66d. 6m. is to 26.4 Minutes, ſo is 90 Degrees to Minutes 28.88, the Diſtance from the firſt Place of departure.

D. M.
Latitude ſailed from- - - - - - - - - 41 : 30
The Difference of Latitude m. 11.7. or 0 : 12 North

Added, gives the Latitude the Ship is in 41 : 42 North

And the middle Latitude is - - - - - 41 : 36 North
Subtracted from - - - - - - - - - 90 : 0

Gives the Comp. of the Middle Latitude 48 : 24

Then to find the Difference of Longitude, ſay,

As S. 48d. 24m. is to 26.4 m. ſo is S. 90d. to 35.31 min. the Difference of Longitude.

D. M.
The Longitude ſailed from is - - - - 10 : 20 Eaſt
The Difference of Longitude 35.31 min. or 0 : 35 Weſt

Subtract, it gives the Long. the Ship is in 9 : 45 Eaſt

Secondly

Secondly, The Uſe of Gunter's Scale *in* Mercator's Sailing.

CASE I.

The Latitude and Longitude of two Places being given, to find the Courſe and Diſtance between them.

Example. I demand the Courſe and Diſtance from the *Lizard* to *Barbadoes?* Latitudes and Longitudes of thoſe Places being ſuppoſed as follows:

		d.	m.			d.	m.	
Lizard	Lat.	49	57	North	Long.	5	14	W.
Barbadoes		12	58	North		58	50	W.
The Diff. of Lat.		36	59	South, Diff. Long.		53	36	W.
		60				60		
Minutes		2219		Minutes		3216		

To anſwer the Queſtion, the Proportions are theſe.

1. As the Meridional Difference of Latitude, is to the Difference of Longitude, ſo is Radius to the Tangent of the Courſe.

2. As the Sine Complement of the Courſe is to the Difference of Latitude, ſo is Radius to the Diſtance of the two Places.

The Meridional Difference of Latitude is thus found:

Extend the Compaſſes on the Meridional Line, from one Latitude to the other; that Extent meaſured on the Equinoctial Line (the next Line adjoining to the Meridional Line marked EP.) gives the Meridional Difference of Latitude.

Thus the Extent from Latitude 49d. 57m. to Latitude 12d. 58m. on the firſt, being meaſured on the latter, is deg. 44 $\frac{75}{100}$ or 44d. 45m. or 2685 Minutes, the Meridional Difference of Latitude: Then ſay, As 2685 is to 3216 ſo is T. 45 to T. 50.9, the Courſe from the South Weſtward, or S. W. 5 Degrees 9 Minutes Weſterly: And again,

As S. 39d. 51m. is to 2219m. ſo is S. 90d. to 3463m.

CASE II.

Both Latitudes and Courſe being given; to find the Diſtance and Difference of Longitude.

The Proportions are theſe:

1. AS the Sine Complement of the Courſe is to the Difference of Latitude, *&c.* as before in the Second Caſe of Plain-Sailing, to find the Diſtance and Departure from the Meridian.

2. As the Sine Complement of the middle Latitude is to the Departure from the Meridian, ſo is the Radius to the Difference of Longitude.

Or thus; as the Sine Complement of the Courſe is to the Meridional Difference of Latitude, ſo is the Sine of the Courſe to the Difference of Longitude.

Example. Admit from the *Lizard* in 49 Deg. 57 Min. North Latitude, and Longitude 5d. 14m. Weſt, we made (when Leeway, Variation, *&c.* were allowed for) our Courſe to be South 39 Deg. Weſterly; and then by Obſervation was in 44d. 58m. North Latitude; I demand the Diſtance run, and Longitude in.

Latitude ſailed from ——— ——— 49d. : 57m. North
Latitude by Obſervation ——— 44d. : 58m. North

Subtracted, is the Diff. of Lat. —— 4d. : 59m. Southerly
60

Minutes 299
The Middle Latitude is ——— ——— 47d. : 27m.
Subtract from ——— ——— ——— 90d. : 0m.

Comp. of the Middle Latitude —— 42d. : 33m.

1. As S. 51d. is to 299m. ſo is S. $\left\{\begin{matrix}90\\39\end{matrix}\right\}$ d. to $\left\{\begin{matrix}385\\242\end{matrix}\right.$ $\begin{matrix}\text{Diſt.}\\\text{Depart}\end{matrix}$

2. As 42d. 33m. is to 242 Minutes, ſo S. 90d. to 358 Minutes, the Difference of Longitude. Or thus, the Extent from 49d. 57m. on the Meridian Line, 44d. 58 m. meaſured on the Line of equal Parts is 7.4d. or 7d. 24m. or 444 Minutes, for the Meridional Difference of Latitude: Then,

As 51d. is to 444 Minutes, ſo is S. 39d. to 358m. Or thus;

As 299 Minutes is to 242 Minutes, ſo is 444 Minutes to 358 Minutes, as before; which is the Difference of Longitude.

d. m.
The Longitude ſailed from ——— ——— 5 : 14 Weſt
The Difference of Longitude 358 min. or — 5 : 58 Weſt

Added, gives the Longitude the Ship is in 11 : 12 Weſt

CASE III.

Both Latitudes and Diſtance run being given, to find the Courſe and Difference of Longitude.

To perform this, the Proportions are theſe:

1. AS the Diſtance ſailed is to Radius, ſo is the Difference of Latitude to the Sine Complement of the Courſe, as in the fourth Caſe of Plain Sailing, by which Caſe alſo you may find the Departure from the Meridian, or Meridian Diſtance.

2. As the Sine Complement of the middle Latitude is to the Departure, ſo is the Radius to the Difference of Longitude: Or thus;

As the Difference of Latitude is to the Departure from the Meridian, ſo is the Meridional Difference of Latitude to the Difference of Longitude.

Example. A Ship in 46d. South Latitude, and 1d. 15m. Weſt Longitude, ſails 100 Leagues North Eaſtward, and then by Obſervation is in Latitude 42d. South: I demand her Courſe, Departure from the Meridian, and the Longitude ſhe is in?

Latitude ſailed from is - - - - 46d. South
Latitude by Obſervation is - - 42d. South

Subtracted, gives the Diff. of Lat. 4d. or 80 Leagues N.

The middle Latitude is - - - 44d. whoſe Comp. is 46d.

1. As 100 Leagues is to S. 90d. ſo is 80 Leagues to S. 53 Deg. 15 Min. the Complement of the Courſe; ſo that the Courſe is 36 Deg. 45 Min. North Eaſtward, or N.E. by N. a Quarter E. And then again,

As S. 90d. is to 100 Leagues, ſo is S. 36d. 45m. to 60 Leagues, the Departure from the Meridian.

As S. 46 Deg. is to 60 Leagues, ſo is S. 90 Deg. to 83 Leag. the Difference of Longitude: Or thus: The Extent from 46d. to 42d. on the Meridional Line makes 5. 5d. or 110 Leagues on the equal Parts, which is the Meridional Diff. of Latitude; and then it is,

As 80 leag. is to 60 leag. ſo is 110 leag. to 83 leag. } diff. long.
Or, as 4d. is to 3d. ſo is 5. 5d. to 4. 11d. }
Longitude ſailed from is - - - - - 1d : 15m. Weſt
The Difference of Longitude 83 leag. or 4d. : 9m. Eaſt

Subtracted gives the Long. the Ship is in 2d. : 54m' Eaſt

CASE IV.

Both Latitudes and Departure from the Meridian being given, to find the Courſe, Diſtance run, and Diff. Long.

1. THE Courſe and Diſtance run is found by the ſixth Caſe of Plain Sailing.

2. The Difference of Longitude is found as in the ſecond, third, or fourth Caſe in *Mercator*.

Example. A Ship in 33 Degrees North Latitude, and 178 Degrees Weſt Longitude, ſails South Weſtward until ſhe has departed from the Meridian 58 Leagues, and then ſhe is in Latitude 28d. 36m. North, I demand her Courſe, Diſtance run, and what Longitude ſhe is in?

d. m.
Latitude ſailed from ——— 33 : 0 North
Latitude the Ship is in ——28 : 36 North

The Difference of Latitude 4 : 24 or 88 Leagues

The Middle Latitude is —30 : 48 Comp. 59d. 12m.

1. As 88 Leagues is to 58 Leagues, ſo is T. 45 Deg. to T. 33d. 20m. which is the Courſe South Weſterly, or SW. by S.

2. As S. 33d. 20m. is to 58 Leagues, ſo is S. 90d. to 105 Leagues, the Diſtance ſailed.

3. The Meridional Difference of Latitude 5. 15 Deg. or 5 Deg. 9 Min. or 103 Leagues is found as before directed.

4. As $\left\{\begin{matrix}\text{S. 59d 12m.}\\ \text{88 Leag.}\end{matrix}\right\}$ is to 58 Leag. ſo is $\left\{\begin{matrix}\text{S. 90 Deg.}\\ \text{103 Leag.}\end{matrix}\right\}$ to 67 Leagues the Difference of Longitude.

5. Longitude ſailed from ——— ——— 178 : 0 Weſt
The Difference of Longitude 67 Leag. or 3 : 21 Weſt

Added, the Sum is ——— ——— ——— 181 : 21
Which ſubtract from ——— ——— ——— 360 : 0

Remainder is the Longitude the Ship is in 178 : 39 Eaſt

CASE V.

One Latitude, Courſe and Diſtance run being given, to find the other Latitude, and Difference of Longitude.

1. THE Difference of Latitude and Departure from the Meridian is found by the firſt Caſe of Plain Sailing and conſequently the other Latitude.

2. The Difference of Longitude is found as before in the ſecond or third Caſe of *Mercator*.

Example. If a Ship ſails SE. by S. 120 Leagues from a Port in 53d. 30m. North Latitude, and 2d. 15m. Weſt Longitude, what Latitude and Longitude is ſhe in?

As S. 8 Points is to 120 Leagues, ſo is S. 5 Points to 100 Leagues, the Difference of Latitude.

And as S. 8 Points is to 120 Leagues, ſo is S. 3 Points to 67 Leagues the Departure from the Meridian.

	D.	M.	
Latitude ſailed from	53	30	North
The Diff. of Latitude 100 Leagues, or	5	0	South,
Subſtracted gives the Lat. the Ship is in	48	30	North.

And the Middle Latitude is 51 Comp. 39d.
The Meridional Diff. Lat. is 8d. or 160 Leagues.

As $\left\{\begin{matrix}\text{S. 39d.}\\ \text{100 Leagues}\end{matrix}\right\}$ is to 67 Leag. ſo is $\left\{\begin{matrix}\text{S. 90d.}\\ \text{160 Leagues}\end{matrix}\right\}$ to 107 Leagues the Difference of Longitude.

	D.	M.	
Longitude ſailed from is	2	15	Weſt
The Diff. of Longitude 107 Leagues, or	5	21	Eaſt
Subtracted, gives the Longitude ſhe is in	3	6	Eaſt

So that the Ship hath croſſed the firſt Meridian.

CASE VI.

Sailing in a Parallel, to find the Difference of Longitude.

To do this, the Proportion is thus;

AS the Sine Complement of the Parallel, or Latitude, is to the Diſtance ſailed Eaſt or Weſt, ſo is Radius to the Difference of Longitude.

Example. If a Ship ſails Weſt 390 Minutes in the Latitude of 50d. 10m. and departs from 2d. 45m. Eaſt Longitude, I demand what Longitude the Ship is now in?

As S. 39d. 50m. is to 390m. ſo is 90d. to 610m. the Difference of Longitude.

	d.	m.	
Longitude ſailed from, is ———————	2	: 45	Eaſt
The Difference of Longit. 610 min. or ——	10	: 10	Weſt
Subtracted, gives the Longit. the Ship is in	7	: 25	Weſt

CASE VII.

The Diff. of Longitude of two Places in one Parallel or Latitude being given, to find their Diſtance in that Parallel.

THE Proportion is thus; as Radius is to the Difference of Longitude, ſo is the Sine Complement of the Latitude to the Diſtance in that Parallel.

Example 1. Suppoſe Cape *St. Vincent* in *Portugal* and Cape *Henry* in *Virginia*, both in 37 Deg. North Latitude, and their Longitude as hereunder, what is their Diſtance in that Parallel?

Cape St. *Vincent*	Longitude	9 : 6 Weſt.
Cape *Henry*		76 : 23 Weſt.

Subtracted, gives the Diff. Long. 67 : 17 or 4037 Min.
Latitude of both Places is nearly ———— 37 Deg. N.
Subtract from ————————————— 90

Remains Complement of the Latitude——— 53

2. As S. 90 Degrees is to S. 53 Degrees, ſo is 67,3d. equal to 67d. 17m. to 53,73d. or 53d. 44m. or 3224m. the Diſtance required. Or thus,

2. As 90 Degrees is to S. 53 Degrees, ſo is 4037 Minutes to 3224m. the Diſtance in the Parallel, as above.

Example 2. Suppoſe two Ships under the Equinoctial, 100 Leagues aſunder, and each ſails North till both come into Latitude 60 Degrees, how far are they now aſunder? *Anſwer*, 50 Leagues. For,

As S 90 Degrees is to S. 30 Degrees, ſo is 100 Leagues to 50 Leagues, the Diſtance required.

CASE VIII.

To find how many Minutes or Miles make a Degree of Longitude in any Parallel of Latitude.

The RULE.

AS Radius is to the Sine Complement of the Latitude, ſo is 60 Min. (a Degree on the Equinoctial) to the Minutes making a Degree of Longitude in the Parallel deſired.

Example. In the Latitude of 50 Degrees, I demand how many Minutes of Eaſting and Weſting make a Degree of Longitude? *Anſwer*, 38 ½ Minutes. For,
As S. 90 Deg. is to S. 40 Deg. ſo is 60 Min. to Min. 38.5 or 38 and a half, making one Degree of Longitude in Latitude 50 Degrees.

This may be done by the Plain-Scale thus:

Take the given Latitude from the Chords, and meaſure it on the Line M.L. (which is Miles of Longitude) and it will anſwer your Deſire: As, for Inſtance, take 50 Degrees from the Chords, and meaſure it on the Scale M. L. and it ſheweth 38 Min, and a half, the ſame as before.

VI. *The Uſe of* Gunter's Scale *in Aſtronomy.*

PROBLEM I. *The Sun's Place in the Ecliptic, and his greateſt Declination being given, to find his Right Aſcenſion and preſent Declination.*

To perform this, obſerve the following Proportions :

Firſt for the Right Aſcenſion.

1. AS Radius is to the Sine Complement of the Sun's greateſt Declination, ſo is the Tangent of the Longitude, from the neareſt Equinoctial Point, to the Tangent of his Right Aſcenſion from the ſaid Point.

The Names and Characters of the 12 *Sines.*

♈	*Aries*	North Signs	♎	*Libra*	South Signs
♉	*Taurus*		♏	*Scorpio*	
♊	*Gemini*		♐	*Sagittarius*	
♋	*Cancer*		♑	*Capricornus*	
♌	*Leo*		♒	*Aquarius*	
♍	*Virgo*		♓	*Piſces*	

Note 1. For working upon Gunter's Scale the Sun's greateſt Declination may be taken 23½d. In the following Examples, it is ſuppoſed 23d. 29m. but at preſent it is 23d. 28m. and is altering a few ſeconds every Year.

Note 2. The Beginning of *Aries* and *Libra* are the two Equinoctial Points.

Note 3. This Proportion (above) finds the Sun's Right Aſcenſion only when he is in the firſt Quarter of the Ecliptic, that is, ♈, ♉, ♊. But when he is in the ſecond Quarter, ♋, ♌, ♍, ſubtract from 180 Deg. and when in ♎, ♏, and ♐, add to it 180 Degrees, and in the laſt Quarter ♑, ♒, and ♓, ſubtract what is found by this Operation, from 360 Degrees, and you have the Sun's Right Aſcenſion from ♈, for any Place in the Ecliptic deſired.

2. As Radius is to the Sine of the Sun's Longitude from the neareſt Equinoctial Point, ſo is the Sine of the Sun's greateſt Declination to the Sine of his preſent Declination.

Note, The Sun being in ♈, ♉, ♊, ♋, ♌, and ♍, his Declination is North, but in ♎, ♏, ♐, ♑, ♒, and ♓, it is South; alſo when the Sun is in ♑, ♒, ♓, ♈, ♉, ♊, the neareſt Equinoctial Point is ♈, but in ♋, ♌, ♍, ♎, ♏, ♐, the neareſt Equinoctial Point is ♎.

Example.

When the Sun's Place in the Ecliptic is ♉ 24d. 15m. *What is his Right Aſcenſion and Declination?*

The Sun being in ♉ 24 Degrees 15 Minutes, his Longitude from the neareſt Equinoctial Point (being now the beginning of ♈) is 54 Degrees 15 Minutes, and the Complement of his greateſt Declination is 66 Degrees 31 Minutes. Then it follows:

1. As S. 90 Degrees is to S. 66 Degrees 31 Minutes, ſo is Tangent 54 Degrees 15 Minutes, to Tangent 51 Degrees, 52 Minutes, the Sun's Right Aſcenſion (from the Beginning of ♈) required.

1. By *Gunter* with Compaſſes.

The Extent from Sine 90 Degrees, to Sine 66 Degrees 31 Minutes will reach from Tangent 54 Degrees, 15 Min. to Tangent 51 Degrees 52 Min. the Sun's Right Aſcenſion.

1. By the *Sliding Gunter.*

1 Let the middle Piece be ſo put in, that Sines may ſlide againſt Sines, and Tangents againſt Tangents.

2. Then bring 90 Degrees in Sines, on the outſide Piece againſt 66 Degrees 31 Minutes in Sines, on the middle Piece, then againſt 54 Degrees 15 Min. in Tangents, on the middle Piece, is 51 Deg. 52 Min. in Tangents, on the outſide Piece, the Right Aſcenſion as above.

This Proportion being to be wrought on Sines and Tangents, jointly, I thought it neceſſary to expreſs the Manner of its Operation on both *Gunters*, but ſhall wave it in the reſt, and only write the Proportion in Words and Figures, according to the particular Examples as follows, for the Suns Declination.

2. As S. 90 Degrees is to S. 54 Deg. 15 Min. ſo is S. 23 Deg. 29 Min. to S. 18 Deg. 52 Min. the Sun's Declination North, increaſing.

PROB. II. *The Latitude of a Place, and the Sun's Declination being given, to find his Amplitude and Aſcenſional Difference, and conſequently his Riſing and Setting, and the Length of the Day and Night.*

To perform this Problem, the Proportions are theſe:

1. AS the Sine Complement of the Latitude is to Radius, ſo is the Sine of the Sun's Declination to the Sine of his Amplitude.

Note, The Amplitude and Declination are always of one Kind; that is, both North, or both South.

2. As the Tangent Complement of the Latitude is to the Tangent of the Sun's Declination, ſo is Radius to the Sine of his Aſcenſional Difference.

Note 1. The Aſcenſional Difference being reduced into Time, at the Rate of 15 Degrees for one Hour, and then added to, and ſubtracted from 6 Hours, the one is Sun-riſing, and the other Sun-ſetting.

Note 2. If the Latitude and Declination are both North or both South, the Sun riſeth before, and ſets after Six of the Clock; but if one be North, and other South, the contrary.

Note 3. If the Sun's riſing and ſetting be doubled ſeverally, the former is the Length of the Night, and the latter is the Length of the Day.

Note 4. By this Problem the Tables of Amplitudes and Semidiurnal Arches, &c. in this Book were calculated.

Example. The Latitude being 51 Deg. 32 min. North, Sun's Declination 23 Deg. 29 Min. North, I demand his Amplitude and Aſcenſional Difference; alſo his Riſing, Setting, and Length of the Day and Night.

		d.	m.		d.	m.
Anſw. Sun's Amplitude is		39	50	Aſcen. Diff.	33	10
Sun-ſetting	is Hours	8	13	Leng. of Day	16	26
Sun-riſing		3	47	Leng. of Night	7	34

For (by the preceding Proportions,)

1. As S. 38d. 28m. is to S. 90d. ſo is S. 23 deg. 29m. to 39 deg. 50 min. the Amplitude North, becauſe the Declination is North, that is, the Sun riſeth Eaſt 39 deg. 50 min. Northerly, and ſetteth Weſt 39d. 50m. Northerly.

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2. As T. 38 Deg. 28 Min. is to T. 23 Deg. 29 Min. ſo is S. 90 Deg. to S. 33 Deg. 10 Min. the Aſcenſional Difference, which being reduced into Time, is 2 Hours 13 Minutes, and added to 6 Hours, is 8 Hours 13 Minutes for Sun-ſetting; which doubled is 16 Degrees, 26 Minutes the Length of the Day.

Again, 2 Hours 13 Minutes ſubtracted from 6 Hours, is 3 Hours 47 Minutes for Sun-riſing; which doubled is 7 Hours 34 Minutes the Length of the Night.

Note. Every Degree is 4 Minutes of Time, and every 15m. of a Degree is one Minute of Time. Hence, the following eaſy Rule to reduce Degrees and Minutes in an Arch of a Circle into Time. Multiply the Minutes in the Arch by 4, and divide by 60 gives the Minutes of Time, contained in the Arch.

Example. Reduce 10d. 15m. into Time; the 10d. 15m. are 615m. which, multiplied by 4, gives 2460; this divided by 60 makes 41 Minutes of Time.

And to reduce Time into Degrees, multiply the Min. of Time by 60, divide the product by 4, the Quotient will be the Minutes contained in the Arch, which divided by 60 will be reduced into Degrees.

PROB. III. *The Latitude of a Place, and the Sun's Declination being given, to find his Altitude and Azimuth at Six o'Clock.*

To ſolve this, ſay,

1. AS Radius is to the Sine of the Latitude, ſo is the Sine of the Sun's Declination to the Sine of his Altitude at Six of the Clock.

2. As Radius is to the Sine Complement of the Latitude, ſo is the Tangent of the Sun's Declination to the Tangent of his Azimuth (from the Eaſt or Weſt) at Six of the Clock.

Note, The Azimuth is from the Eaſt at Six in the Morning, and from the Weſt at Six in the Afternoon, Northerly, in North Latitude, but Southerly in South Latitude.

Example, In 51d. 32m. North Latitude, the Sun's Declination being 23d. 29m. North, what is his Altitude and Azimuth at Six of the Clock?

Anſwer, His Altitude is 18d. 11m. and his Azimuth Eaſt 15d. 7m. Northerly, or 74d. 53m. North Eaſterly, or Weſterly; For,

1. As 90d. is to S. 51d. 32m. ſo is S. 23d. 29m. to S. 18d. 11m. the Altitude at Six of the Clock.

2. As S. 90d. is to S. 38d. 28m. ſo is T. 23d. 29m. to T. 15d. 7m. the Azimuth at Six; that is, 74d. 53m. North Eaſterly at Six in the Morning, but North Weſterly in the Afternoon.

PROBLEM IV.

The Latitude of a Place and Sun's Declination being given, to find his Altitude, and the Hour of the Day, when he is in Eaſt or Weſt.

To perform this, the Proportions are theſe;

1. AS the Sine of the Latitude is to Radius, ſo is the Sine of the Sun's Declination to the Sine of its Altitude, when Eaſt or Weſt.

2. As the Tangent of the Latitude is to the Tangent of the Sun's Declination, ſo is Radius to the Sine of the Hour from Six of the Clock when he is Eaſt or Weſt.

Note 1. The Sun is Eaſt after Six in the Morning, but Weſt before Six in the Afternoon.

Note 2. The Hour found (by the laſt Proportion) being reduced into Time (by allowing 15 Deg. to an Hour) and added to, or ſubtracted from 6, gives the Hour of the Day, when the Sun is Eaſt or Weſt.

Example. In 51d. 32m. North Latitude, the Sun's Declination being 23d. 29m. North, what is his Altitude, and what Time of the Day is it when he is in Eaſt or Weſt?

Anſwer, His Altitude is 30d. 35m and the Hour of the Day is { 7h. 21 Min. Morning, when Eaſt.
4h. 39m. Afternoon, when Weſt. }

For (by the preceding Proportions)

1. As S. 51d. 32 m. is to S. 90d. ſo is S. 23d. 29m. to S. 30d. 55m. the Sun's Altitude when either Eaſt or Weſt.

2. As T. 51d. 32m. is to T. 23d. 29m. ſo is S. 90d. to S. 20d. 11m. the Hour from Six; which makes 1 Hour 21 Minutes, and added to 6, is 7h. 21m. but ſubtracted from 6, is 4h. 39m. the former is the Time when the Sun is Eaſt in the Morning, and the latter the Time when he is Weſt in the Afternoon.

PROBLEM V.

Suppoſing the Sun to be in the Equator or Equinoctial (that is, to have no Declination) and the Latitude of a Place, and the Sun's Altitude to be given, to find his Azimuth, and the Hour of the Day.

This PROBLEM is thus performed;

1. AS the Tangent Complement of the Latitude is to the Tangent of the Sun's Altitude, ſo is Radius to the Sine Complement of his Azimuth from the South in North Latitude, but from the North in South Latitude: Eaſterly in the Forenoon; and Weſterly in the Afternoon.

2. As the Sine Complement of the Latitude is to Radius, ſo is the Sine of the Sun's Altitude to the Sine Complement of the Hour from Noon.

Example. In 51d. 32m. North Latitude, the Sun having no Declination, and his Alt. being 21d. 50m. in the Forenoon, I demand his Azimuth and the Hour of the Day?

Anſw. His Azimuth is South 59d. 45m. Eaſterly, that is, the Sun is upon the S. E. by E. a quarter E. Point of the Compaſs, and the Hour of the Day is Hours 8.27 Minutes Morning. For (by the above Proportions)

1. As T. 38d. 28m. is to T. 21d. 50m. ſo is S. 90d. to S. 30d. 15m. whoſe Complement is 59d. 45m. is the Sun's Azimuth required.

2. As S. 38 Deg. 28 Min. is to S. 90 Deg. ſo is S. 21 Deg. 50 Min. to S. 36 Deg. 50 Min. whoſe Complement is 53 Deg. 10 Min. or 3 Hours 33 Minutes, which ſub-

tracted from 12, gives 8 Hours 27 Minutes, or 27 Min. after 8 of the Clock in the Morning, the Time of the Day required.

PROBLEM VI.

The Latitude of a Place, the Sun's Declination and his Altitude being given, to find his Azimuth, and the Hour of the Day.

The Performance of this is as follows;

1. TAKE the Complement of the Latitude, the Complement of the Sun's Altitude, and the Sun's Diſtance from the Pole (which is his Declination added to 90 Deg. when the Latitude and Declination, are one North and the other South, but both being North or South it is the Complement of the Declination, and add them together into one Sum.

2. From half that Sum ſubtract (to find the Sun's Azimuth) the Sun's Diſtance from the Pole, but (to find the Hour) ſubtract the Complement of his Altitude, and note the Remainder.

3. To find the Azimuth, you have theſe two Proportions following,

Firſt, As Radius is to the Sine Complement of the Latitude, ſo is the Sine Complement of the Altitude to a fourth Sine. Then again,

Secondly, As that fourth Sine is to the Sine of the half Sum, ſo is the Sine of the Remainder to a fifth Sine; againſt which on the Line of verſed Sines is the Sun's Azimuth from the North in North Latitude, but from the South in South Latitude.

4. To find the Hour, theſe are the two Proportions which follow;

Firſt, As Radius is to the Sine Complement of the Latitude, ſo is the Sine of the Sun's Diſtance from the Pole to a fourth Sine.

Secondly, As that fourth Sine is to the Sine of the half Sum, ſo is the Sine of the Remainder to a fifth Sine; againſt which on the verſed Sines, is the Hour of the Day from Noon.

Example. In 51 Deg. 30 Min. North Latitude, the Sun's Declination being 15 Deg. 10 Min. North, and his Altitude obſerved to be 11 Deg. 30 Min. I demand his Azimuth and Hour of the Day?

	d.	m.		d. m.		d. m.
	90	0		90. 0		90. 0
Latitude	51	30	North Declinat.	15.10	Alt.	11.30
Comp.Lat.	38	30	Sun'sdiſt.fromPole	74.50	Com.Alt.	78.30
Comp.Alt.	78	30	Comp. Latitude	38.30		
Sun's Diſt.	74	50	Comp. Altitude	78.30		
Sum is	191	50	Sum is ———	191.50		
half Sum is	95	55	The half Sum is	95.55		
Remainder	21	5	Remainder is —	17.25		

Then to find the Azimuth, ſay;

1. As S. 90d. is to S. 38d. 30m. ſo is Sine 78d. 30m. to Sine 37d. 20m. the fourth Sine.
2. As S. 37d. 20m. is to S. 95d. 55m. ſo is Sine 21d. 5m. to S. 36d. againſt which, on Verſed Sines is 80d. the Sun's Azimuth from the North Eaſterly, if in the Forenoon, but North Weſterly in the Afternoon.

And to find the Hour of the Day, it is thus;

1. As Sine 90d. is to Sine 38d. 30m. ſo is Sine 74d. 50m. to Sine 37d. the fourth Sine.
2. As Sine 37d. is to Sine 95d. 55m. ſo is Sine 17d. 25m. to Sine 29d. 40m. againſt which on the verſed Sines, is 90d. 30m. or 6 Hours 2 Minutes, which is the Hour from Noon; that is 58 Minutes after Five of the Clock in the Morning, or two Minutes after Six in the Afternoon.

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DESCRIPTION and USE of the

SECTOR.

1. THIS uſeful Inſtrument may be of any Length, but it is commonly made one Foot ſix Inches, or two Feet long, to open with a Joint in the Middle like a Carpenter's Rule, and one Inch and a Half or more in Breadth, and of any Thickneſs at Pleaſure, according to the Matter it is made of, which may be either Box-wood, Ivory, Braſs, or Silver.

2. There are two Sorts of Sectors, known by the Names of *Gunter*'s and *Forſter*'s Sector, and ſometimes both put on one Inſtrument, that is *Gunter*'s Sector put on one Side of it, and *Forſter's* on the other.

3. The Lines on *Gunter*'s Sector are theſe, The *Line of Lines* (marked at the End with L) *Lines of Sines* (marked S) *Superficies* (marked Sup.) *Solids*, (marked Sol.) Line of *Metals*, Line of *Equated Bodies*, Line of *Inſcribed Bodies*, &c.

4. The Lines on *Forſter*'s Sector are theſe Five, *viz.* The *Line of Lines*, or *Equal Parts*, *Chords*, *Sines*, *Tangents*, and *Secants*, each marked at the End with its Name, or firſt Letter of its Name.

5. All *Sector-Lines* or *Scales*, meet at the Centre of the Head (where the Joint is) on the Left-hand, and from thence are figured towards the Right, each being twice repeated; that is, one on each Leg or Side of the *Sector*, anſwering one another.

The *Sector* is uſeful in Projection to reduce or to make a Scheme to any poſſible Magnitude: Alſo in Proportion, to work any ſtated Canon or Proportion in *Arithmetic*, *Geometry*, *Trigonometry*, *Navigation*, *Aſtronomy*, &c. of which I will give a brief Account, yet ſo as the Learner may be informed how to employ them further.

I. *The Uſe of the* Sector Lines *for Projection.*

IN Projection it is often required to enlarge or diminiſh the Scale, that the Draught deſigned may be of its deſired Magnitude; in doing of which are uſed Lateral and Parallel Diſtances, or Extents of the Compaſſes; and to avoid a needleſs Repetition of the ſame Things, take once for all what is meant by a Lateral, and Parallel Diſtance, or Extent of the Compaſſes.

1. As *Lateral Diſtance* (in any Line or Scale) is the Extent or Diſtance taken on the ſame Line, on the ſame Side or Leg of the Sector from the Beginning thereof, to any Number therein deſired.

As for Example; the Lateral Sine of 30 Degrees is the Diſtance of 30 from the beginning of the Line of Sines, and ſo it is in the Line of equal Parts, Chords, Tangents, Secants, &c.

2. A *Parallel Diſtance* (in any Line or Scale on the Sector) is the Extent or Diſtance, taken acroſs from any Number in any Line on one Leg of the Sector to the like Number in the like Line on the other Leg of the Sector.

Or the neareſt Diſtance from any Number on one Leg (taken acroſs) to the like Number of the Line on the other Leg of the Sector.

As for Example: The Parallel Sine of 30 Degrees is (ſuppoſing the Sector oppened to any Angle) the Diſtance from 30 in the Line of Sines on one Leg of the Sector, to 30 deg. in the Line of Sines on the other Leg.

Or, the neareſt Diſtance from 30 in the Line of Sines on one Leg, to 30 in the Line of Sines (that is to ſay) the Line iſſuing from the Centre of the Joint (or Head) on the other Leg, is the Parallel Sine of 30 Degrees. In like Manner it is done in any other Line or Sale.

This being underſtood, the enlarging or diminiſhing and of the Sines, or the finding a Chord, Sine, Tangent, or Secant, to any propoſed Radius, will not be difficult;

and for the Learner's further Information take this General Rule.

I. *To find the Chord, Sine, Tangent, and Secant,* &c. *to any Radius (greater or leſs) propoſed.*

The General RULE is thus;

1. Take the propoſed Radius in the Compaſſes, and make it a Parallel on the Sector in the Radius of any one Line, that is, open the Sector till the propoſed Radius in the Compaſſes, be a Parallel Chord of 60 Degrees in the Line of Chords; or a Parallel Sine of 90 Degrees in the Line of Sines; or a Parallel Tangent of 45 Degrees in the Line of Tangents; or a Parallel Secant of 0 Degrees in the Line of Secants; for the Chord of 60, Sine of 90, Tangent of 45, and Secant of 0 Degrees are equal, and each equal to Radius.

2. The Sector being kept at that opened Diſtance, or Angle, the Parallel Diſtance in any Line will be a Lateral Diſtance on a like Line to the propoſed Radius, that is, a Parallel Chord of 10, 20, 30, *&c.* is the Chord of 10, 20, 30, *&c.* to the propoſed Radius; alſo a Parallel Sine, Tangent and Secant of 20, 30, 40, *&c.* is the Sine Tangent and Secant of 20, 30, 40, *&c.* to the aforeſaid Radius.

II. *The Uſe of the* Sector *in working Proportions.*

SUppoſing the Learner underſtands how to take a Lateral Diſtance on the Line of Lines (otherwiſe called Equal Parts) on the Chords, Sines, *&c.* and to apply them parallel in any Time on the Sector, the working of a Proportion is thus:

A General Rule to work by the Sector.

1. Take the Second Term Lateral (that is, from the Beginning of the Line to the propoſed ſecond Term) and opening the Sector, apply that Extent Parallel (that is,

is acroſs) in the firſt Term; then ſtay the Sector at this Parallel Extent.

2. Take the Parellal Diſtance of the third Term, and meaſure it Laterally, and it gives the fourth Term ſought or required.

Or more briefly thus: As the Lateral ſecond Term is to the Parallel firſt Term; ſo is the Parallel third Term to the Lateral fourth Term.

This one Rule is ſufficient for any Proportion whatever, and will appear ſo by a few Examples.

PROB. I. *To multiply by the Line of Lines on the* Sector.

The Proportion is,

AS 1 is to the Multiplier, ſo is the Multiplicand to the Product.

Example. What is the Product of 8 multiplied by 4?

The Analogy, or Proportion is this;

As 1 is to 4, ſo is 8 to the Product 32, thus found by the Sector, and general Rule aforeſaid.

1. On the Line of Lines, (that is the Line of Equal Parts) take the ſecond Term 4 Lateral, that is, from the Centre of the Joint, and the Beginning of the Line to 4 in the ſame Line.

2. Open the Sector till you fit the (aforeſaid Lateral) Diſtance in the Compaſſes in the Parallel of 1 and 1, or 10 and 10, that is, ſet it over from 10 to 10 at the End of the ſame Line, and now being counted for 1 and 1, the firſt Term, keep the Sector juſt at that Angle or Opening.

3. The Parallel Diſtance of the third Term 8; that is, from 8 to 8 taken acroſs from one Leg to the other in the ſaid Line of Lines, and meaſured Laterally (that is, from the Beginning of the Line towards the End) reacheth to 32 the fourth Term, which is the product of 8 multiplied by 4. Or ſhorter thus:

As the ſecond Term 4 (Laterally taken) is to the firſt Term 10 (parallel ſet) ſo is the third Term (taken Parallel) 8, to the fourth Term (meaſured Laterally) which is 32, the Product as above. Or thus, As the Lateral 8, is to the Parallel 10, counted for 1, ſo is the Parallel 4, to the Lateral 32, as above.

PROBLEM II.

To divide by the Line of Lines on the Sector.

The Analogy, or Proportion, is thus:

AS the Diviſor is to 1, ſo is the Dividend in the Quotient. Or thus;

As the Diviſor is to the Dividend, ſo is 1 to the Quotient.

Example 1. How many Square Yards are in 36 Square Feet? *Anſwer*, 4 Square Yards. For (by the above Proportions,)

As 9 is to 1, ſo is 36 to the Quotient 4: Thus to be wrought by the Sector; As Lateral 1 is to Parallel 9, ſo is Parallel 36 to Lateral 4, the Yards required.

PROBLEM II.

To work the Rule of Three by the Line of Lines on the Sectors *or unto three Numbers given, to find a fourth in Geometric Proportion.*

The Analogy is,

AS the firſt Term is to the ſecond Term, ſo is the third Term to the fourth required.

Example 1. If the Diameter of a Circle be 14 Inches, what is the Circumference? *Anſwer* 44 Inches, For, by the Proportion it is thus;

As 7 is to 22, ſo is the Diameter 14, to 44 the Circumference required; by the Sector thus wrought, as Lateral 22, is to Parallel 7, ſo is Parallel 14, to Lateral 44, the Circumference of a Circle whoſe Diameter is 14.

Example 2. If a Plank or Board be 15 Inches broad, and 20 Feet long, how many Feet are in it? *Anſwer*, 25 Feet; For the Proportion is this;

As 12 is to 15 the Breadth, ſo is 20 the Length, to 25 Feet, the Content of the ſquare Board: And by the Sector thus, as Lateral 15 is to Parallel 12, ſo is Parallel 20, to Lateral 25 Feet, the Content of the Plank.

PROB. IV. *The Uſe of the* Sector *in* Plain-Sailing.

Example 1. A Ship in 42d. 10m. North Latitude ſails NE. by N. 104 Leagues; I demand the Latitude ſhe is in, and her Departure from the Meridian?

The Proportions are theſe;

1. As Radius is to the Diſtance ſailed, ſo is the Sine of the Courſe to the Departure from the Meridian. That is by the Sector, thus; As Lateral 104 Leagues (on the Line of Lines) is to Parallel Sine of 90 Degrees, ſo is Parallel Sine of 33 Degrees 45 Minutes (the Degrees of the Courſe from the Meridian) to Lateral 58 Leagues (on the Line of Lines) the Departure from the Meridian.

Note, If 104 Leagues taken Lateral, be troubleſome to fit Parallel in the Sine of 90 Degrees, then take its half, or quarter laterally, and its Anſwer will be accordingly its half or quarter: As here, if you take 52 the half of 104 Leagues, the Anſwer will be 29, whoſe Double is 58 for the Departure from the Meridian, as before.

2. As Radius is to the Diſtance ſailed, ſo is Sine Complement of the Courſe to the Difference of Latitude.

By the Sector *thus*;

As Lateral 104 Leagues is to the Parallel Sine of 90 Deg. ſo is Parallel Sine of 56 Deg. 15 Min. to the Lateral 87 Leagues, the Difference of Latitude; by which you may find the Latitude the Ship is in, as before, in the Uſe of the *Gunter*.

Example 2. A Ship ſails South Eaſterly 'till her Difference of Latitude be 275 Minutes, and the Departure from the Meridian 412 Minutes, I demand her Courſe and Diſtance ſailed?

The Proportions are theſe;

1. As the Difference of Latitude, is to the Departure; ſo is Radius, to the Tangent of the Courſe: That is,

By the Sector thus:

As Lateral 412 Minutes, is to Parallel 275 Minutes; ſo is Parallel Tangent of 45d. (that being Radius now) to Lateral Tangent of 56d. 15m. the Courſes from the Meridian, which makes SE. by E.

2. As the Sine of the Courſe, is to the Departure; ſo is Radius, to the Diſtance ſailed.

By the Sector thus:

As Lateral 412 min. is to Parallel Sine 56 deg. 15 min. ſo is Parallel Sine of 90 deg. (that now being Radius) to Lateral 495 min. the Diſtance ſailed.

After this Manner may any Proportion be wrought by the Sector, which I leave for the Learner's Exerciſe.

The Uſe of the following TABLES of Latitudes and Longitudes.

The firſt Meridian in theſe Tables is ſuppoſed to paſs through London, increaſing on both Sides the ſaid Meridian; that is to ſay, both Eaſtward and Weſtward, and end in 180 Degrees the oppoſite Meridian.

Therefore (according to this Account) all Places on the Eaſt Side of the Meridian of London lie in Eaſt Longitude; and, on the contrary, all on the Weſt Side of it lies Weſt Longitude.

If a Ship be in Eaſt Longitude, ſailing to the Eaſtward, the Longitude increaſeth; but ſailing to the Weſtward the Longitude decreaſeth.

And on the contrary, if a Ship be in Weſt Longitude ſailing to the Weſtward, the Longitude increaſeth, and ſailing to the Eaſtward, it decreaſeth.

Take Notice, that all Places in Eaſt-Longitude, the Sun cometh on their Meridian before it comes on the Meridian of London. Thus; if a Place lie in 15 deg. Eaſt Longitude, the Sun cometh one Hour ſooner to the Meridian there, than it doth to the Meridian of London: If in 30 deg. Eaſt Longitude, then two Hours ſooner; if 45 deg. three Hours ſooner; if 60 Degrees four Hours ſooner; if 75 deg. five Hours ſooner; if 90 deg. ſix Hours ſooner; if 105 deg. ſeven Hours ſooner; and ſo you may reckon for any other Longitude. But on the contrary, all thoſe Places that lie in Weſt Longitude, the Sun or Star cometh on their Meridian after they are paſt the Meridian of London.

To find the Difference of Longitude between any two Places.

If both Places be in Eaſt Longitude, or both in Weſt Longitude, ſubtract the leſs Longitude from the greater, the Remainder is the Difference of Longitude.

If one Place be in Eaſt Longitude, and the other in Weſt Longitude, add them both together, and their Sum is the Difference of Longitude, if it exceed not 180 deg. but when the Sum doth exceed 180 deg. ſubtract it from 360 deg. and the Remainder is the Difference of Longitude required.

The late Circumnavigators have reckoned their Longitude Eaſt from Greenwich, all round the Globe to 360 Degrees.

If the Longitude of any Place laid down in their Works, exceed 180 Degrees, ſubtract the ſame from 360 Degrees, the Remainder will be the Longitude Weſt from Greenwich.

Note, That the Longitudes of Places, tabulated in Mr. COLSON's Mariner's New Calendar, heretofore eſtimated from the Meridian of Lizard, are now reduced to the Meridian of London.

A TABLE containing the Chief Harbours, Headlands and Iſlands in the World, and ſhewing their Latitude and Longitude: Beginning the ſaid Longitude at the Meridian of *LONDON.*

The Sea-Coaſt of Greenland.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Hacluits Headland	79	55	11	0
Fair Foreland	79	20	10	52
Cape Cold, the North End of Charles Iſland	79	0	10	0
Black Point, South-End of it	78	0	10	33
Dear Sound	79	15	12	40
Foul Sound	77	28	13	0
Bell Sound	77	15	12	40
Horn Sound	76	45	13	26
Point Lookout	76	25	15	36
Helies Sound	78	55	21	50
Cape Barcan, or Barcam	78	15	22	11
Cape Blanco	77	45	22	30
Ducks Cove } Edges Iſland	77	35	23	10
Negro Point }	76	55	23	30
Hope Iſland	76	18	23	45
Cherry Iſland, or Bear Iſland	74	30	18	8
Ice Point, or Cape Deſire	77	40	69	10
Admiralty Iſland	75	5	54	50
Langeneſs	74	20	53	36
Croſs Point	72	0	53	12
Fretum Burrough	70	0	61	20
Colgoyen Iſle	69	0	45	0
Cape Candenoſe	69	5	42	35
Cape Barſo	66	30	38	0

North Latitude.

Eaſt Longitude.

The Coaſts from Archangel to the Naze of Norway.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Archangel	64	30	39	0
Cape Grace, or Cape Bona Fortuna	66	0	35	50
Cape Gallant, or Sweetnoſe	68	10	34	45
Kilduyn Iſland	69	30	31	20
River Kola Entrance	69	10	31	5
Fiſher's Iſland	70	0	26	38
North Cape	71	10	25	20
Tromſound Iſland	70	25	15	30
Iſland Sanien, South-Weſt Point	69	35	13	0
Lœſord, Weſt-Point	68	15	9	0
Werro, or Werroy Iſland	67	30	7	30
Dronthem	63	40	10	15
Ranſdel	63	15	6	30
North Point	62	20	5	26
Catts Neſs, or Scuts Neſs S. Point	61	45	3	36
Hearle Iſland, the South-end	60	40	3	38
North Bergen	60	10	5	40
Bommel Iſland, North Point	59	25	5	40
Jedder	58	5	6	10
Naze of Norway	57	45	7	24
Maſterland	57	53	11	45

North Latitude

Eaſt Longitude.

The Sea-Coaſts in the Sound.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Maerden	58	19	8	57
Caperwick	59	20	10	10
Anſlew, or Chriſtianna	59	40	10	0
Gottenberg	57	50	12	15
Cape Kol	56	30	12	13
Elſenberg	56	10	12	30
Vaſtlenborn	55	28	13	0
Chriſtianople	56	0	15	12
Calmer	56	40	16	35
Oeland the South-end	56	17	15	30
Oeland the North-end	57	20	17	0
Dandford	58	40	18	20
Stockholm	59	20	19	30
Aboo	60	40	21	10
Raſeborg	60	28	22	35
Borgo	60	40	26	0

North Latitude.

Eaſt Longitude.

The Sea-Coaſts in the Sound.

Names of Places.	Latitude D.	M.	Longit. D.	M.
Pelting Sound	60	32	26	50
Wyburg	60	52	29	16
Peterſburg	60	0	30	25
Narva	59	27	28	25
Reval	59	27	24	51
Nargin Iſland	59	35	24	30
Sybranneſs in Dagoo, or Dagerort	59	0	23	0
Arenſberg in Geſel Iſland	58	20	23	32
Parnaw	58	30	25	47
Runen Iſland	57	55	24	0
Riga	57	4	24	15
Domeneſs	57	30	24	0
Der Winda	57	15	22	6
Der Memel	55	48	21	36
Coningſburg	54	43	21	35
Dantzic	54	22	18	36
Heel	54	40	19	8
Gotland, the North-end	58	0	20	15
Faro Sound	58	3	18	50
Gotland Wiſbuy	57	30	18	30
Gotland, the South-end	57	0	17	45
Bornholm	55	15	14	45
Camin, or Hamin	54	10	15	0
Jaſmond, or Rugen	54	40	14	0
Roſtock	54	37	18	40
Strelſound	54	25	13	16
Wiſmar	54	10	12	0
Lubec	54	6	9	55
Copenhagen	55	41	12	50
Elſinore	56	22	12	40
Uraniberg	55	54	12	58
Anout, or Anholt Iſland	56	50	11	6
Leſon, or Leſnow Iſland, Jeſou	57	5	10	30
The Scaw	57	30	10	20

North Latitude.

Weſt Longitude.

The Sea-Coaſts of Holland and Flanders, from the Scaw to Calais.

Names of Places.	Latitude D.	M.	Longit. D.	M.
Holyland, or Heighland Iſles	54	24	8	30
Hamburgh	53	41	10	35
Bremen	53	30	9	0
Embden	53	5	7	30
Ameland Iſland, or Amoyland	53	30	6	20
Scheling	53	27	5	58
The Fly	53	16	5	30
The Texel	53	15	5	10
Amſterdam	52	23	4	58
Rotterdam	51	55	4	30
Antwerp	51	10	4	20
The Brill	52	0	4	0
Middleburgh in Zealand	51	37	3	58
Sluys	51	14	3	40
Oſtend	51	14	3	0
Dunkirk	51	2	2	27

North Latitude.

Eaſt Longitude.

The Sea-Coaſts about the Iſland of Iceland.

Grim's Hole, ar Geuberman's Rocks	66	23	22	30
Gamar Iſles, or Gille	65	48	26	54
Weſtmania Iſles	63	30	22	24
Rock Point	64	0	26	24
Snow Hill	65	11	27	14
Fair Foreland	60	20	26	23
Rage Point, or Orgal Bay	66	0	25	25
Marza, or Largeneſs	66	8	24	0
Grimſa Iſle	67	15	22	34
Langeneſs	66	46	12	50
Bargarers Point	66	20	16	34
Silly, or Pappy Iſles	64	50	12	10
Horn Bay	64	50	12	0
Merchants Foreland	63	24	17	5
Portland	64	1	21	5
Green's Iſland	66	50	24	40

North Latitude.

Weſt Longitude.

The Sea Coaſts of Scotland.

Names of Places.	Latitude D.	Latitude M.		Longit. D.	Longit. M.	
Sky Iſland, North End	57	55	North Latitude.	5	45	Weſt Longitude.
Iſland of Lewis, North-end	58	20		7	19	
Ferro Head, or South-end	58	34		5	10	
Shetland South-end	60	4		2	0	
Fair Iſle	59	30		1	24	
Iſles of Orkney	59	10		3	22	
Cath Neſs Point	58	40		2	36	
Buchan Neſs	57	35		1	35	
Aberdeen	57	10		1	45	
Dundee	56	28		2	40	
Leith	56	0		2	56	
Edinburgh	55	58		3	12	
Berwick	55	42		1	55	

The Sea Coaſts of England from Berwick to the Lizard.

Names of Places.	Latitude D.	Latitude M.		Longit. D.	Longit. M.	
Newcaſtle	55	0	North Latitude.	1	30	W. Longitude.
Sheiles, or Sheilds	55	2		1	23	
Sunderland	54	55		1	20	
Hartlepool	54	43		0	56	
Whitby	54	26		1	0	
Scarborough	54	20		0	40	
Flamborough Head	54	9		0	11	E. Lon.
Burlington	54	0		0	8	
The Spurn	53	45		0	13	
Hull	53	52		0	20	W
Grimeſby	53	30		0	56	Eaſt Longitude.
Boſton	53	10		0	25	
Lynn	52	55		0	32	
Wells	53	10		1	0	
Blackney	53	8		0	55	
Cromer	53	10		1	5	
Winterton	52	57		1	22	
Yarmouth	52	45		1	44	

The Sea-Coaſts of England from Berwick to the Lizard.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Aldborough	52	16	1	25
Orfordneſs	52	12	1	16
Ipſwich	52	10	1	5
Harwich	52	5	1	18
Colcheſter	51	58	0	56
LONDON	51	31	0	0
Greenwich Obſervatory	51	29	0	7
Rocheſter	51	28	0	26
Margate	51	27	1	14
The North Foreland	51	25	1	24
Sandwich	51	25	1	14
The Downs	51	23	1	25
The South Foreland	51	10	1	20
Ripraps, a Sand	51	53	1	26
Dover	51	6	1	13
Dongeneſs	50	57	0	51
Rye	51	2	1	45
Beachy	50	46	0	25
Shoreham	50	55	0	17
Portſmouth	50	49	0	50
Iſle of Wight, Newport	50	42	1	25
Pool	50	56	1	54
Weymouth	50	42	2	40
Portland	50	30	2	35
Chiddock	50	46	2	52
Lime	50	43	2	58
Exmouth Bar	50	38	3	25
Berry Head, the S. Point of Torbay	50	26	3	30
Hope's Noſe, the N. Point of Torbay	50	30	3	30
Dartmouth Entrance	50	22	3	35
Start Point	50	7	3	47
Praule Point	50	15	3	45

North Latitude.

Eaſt Longitude.

Weſt Longitude.

The Sea-Coaſts of England.

Names of Places.	Latitude D.	M.		Longit. D.	M.	
The Eddyſtone	50	14	N. Latitude.	4	20	W. Longitude
Plymouth	50	31		4	17	
Ramhead	50	21		4	34	
Foy	50	17		4	38	
Falmouth	50	11		5	10	
LIZARD	49	57		5	14	
Edmonton Church	51	38		0	2	E.

The Sea-Coaſts from the Lizard to Holy-Head.

Land's End	50	6	North Latitude.	6	0	Weſt Longitude.
Gulph	49	56		6	6	
Scilly Iſlands, St. Agnes Lighthouſe	49	56		6	34	
Seven Stones	50	10		6	40	
Hartland Point	51	6		4	35	
Lundy Iſle	51	15		4	40	
Mort Bay, or Mort Point	51	13		4	13	
Briſtol	51	27		2	35	
Swanſey	51	42		3	55	
Caldy Iſland	51	37		4	38	
Milford	51	43		5	0	
St. David's Head	51	58		5	22	
Barſey, or Bardſey Iſland	52	44		5	0	
Liverpool	53	20		3	10	
Wincheſter	53	37		4	20	
Lancaſter	54	42		4	36	
White-Haven	54	27		3	30	
Iſle of Man, Weſt-end	53	45		5	0	
Holy Head	53	23		4	50	

The Sea Coaſt of Ireland.

Names of Places.	Latitude North Latitude.		Longit. Weſt Longitude.	
	D.	M.	D.	M.
Fair Foreland	55	5	6	30
Londonderry	55	10	7	50
Iſland Torry	55	9	8	30
Iſles of Arran	54	48	8	59
Stags of Broad Haven	54	7	10	6
Iſles of Arian	54	55	10	3
Galway	53	7	9	40
Gall, or Doen's Head	52	40	9	30
Lupis's Head	52	24	10	15
Limrick	52	23	9	45
Blaſques	52	0	11	56
Skillocks	51	30	11	55
Cow and Calf	51	22	10	36
Mizan, or Miſſen Head	51	16	11	30
Old Head of Kinſale	51	35	8	58
Cape Clear	51	14	10	0
Kinſale	51	40	8	40
Cork	51	49	8	28
Waterford	52	9	7	2
Wexford	52	20	6	36
Dublin	53	21	6	7
Lumboy Iſland	53	24	7	30

The Sea Coaſts of France.

	North Latitude.		East Lon.	
Calais	50	58	1	56
Dieppe	49	56	1	9
St. Vallery	50	10	0	56
Sain Head, Cape de Antiſer	49	44	0	34
Rouen Mouth	49	34	0	30
Cape Barfleur	49	38	1	16W
Cope de la Hogue	49	47	2	0W
Paris Obſervatory	48	50	0	41

The Sea Coaſts of France.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Alderney	49	50	2	12
Gaſkets	49	50	2	20
Guernſey	49	33	2	47
Jerſey	49	5	2	26
St. Maloes	48	39	1	57
Morlaix	48	33	3	54
Iſland de Baſs	48	50	4	0
Uſhant	48	30	5	7
Conquet	48	27	5	0
Breſt	48	23	4	31
Camarita Bay	48	25	4	28
Seams	48	2	5	0
Weſt Penmark	47	48	4	24
Bell Iſle	47	18	3	20
Nantz	47	14	1	39
Heys Iſle	46	24	2	14
Iſle de Reye the Middle	46	10	1	30
Iſles of Oleron	45	56	1	0
Rochel	46	10	1	16
Bourdeaux City	44	50	0	38
St. Sebaſtian	43	24	1	27
Bilboa	43	29	2	58
Cape Pinas	43	56	6	0
Cape Ortegal	44	46	7	53
Cape Corunna, or Groin	43	28	9	20
Cape Fineſterre	42	52	9	20
Iſles of Bojona	42	29	9	27
Oporto	41	10	8	30
Burlings	39	35	9	24
Rock of Liſbon	38	52	9	29
Liſbon	33	42	8	53
Cape St. Vincent	36	53	9	6
Cape St. Maria	36	58	8	30
Cadiz	36	33	6	7

North Latitude.

Weſt Longitude.

The Coaſts on the Main Continent within the Straits.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Gibraltar	36	6	5	17W
Malaga	36	22	3	56W
Cape de Gat	36	40	1	45W
Cape Paul	38	15	0	15W
Alicant	38	25	0	2W
Cape St. Martin	38	46	0	35
Barcelona	41	26	2	13
Marſeilles	43	18	5	27
Toulon	43	7	5	58
Genoa	44	25	8	43
Leghorn	43	28	10	35
Civita Vechia	42	21	12	25
Rome	41	54	12	29
Naples	40	51	14	20
Cape Spartevento	37	55	16	50
Cape Colonne	38	56	18	5
Gallipoli	39	56	18	40
Cape St. Maria, or Lucia	39	45	19	0
Ancona	43	40	14	26
Venetia, or Venice	45	25	12	10
Zara	44	30	16	35
Raguſa	42	45	20	0
Cattaro	42	47	19	17
La Valona	40	45	20	5
Point Palerma	40	0	20	15
Lepanto	38	10	22	52
Cape Matapan, or Caliga	36	33	22	41
Cape St. Angelo, or Angulo	36	32	23	56
Athens	38	5	23	52

North Latitude.

Eaſt Longitude.

The Coaſts on the Main Continent within the Straits

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Cape Martelo, South Point of Negropont	38	7	25	0
Cape Colon, or Colonne	37	45	24	42
Salonechi	40	41	23	13
Cape Monte Sancto	40	26	24	57
Gallipoli	40	33	27	20
Conſtantinople	41	0	28	56
Cape Barbadore, or Baba	39	30	26	30
Smyrna	38	20	27	25
Cape Barbarnola, or Blane	38	9	26	32
Epheſus	38	1	27	53
Antiochetta	36	30	32	46
Scandaroon, or Alexandretto	36	34	36	30
Antioch	36	11	36	15
Aleppo	36	12	37	24
Tortoſa	35	0	36	30
Tripoly	34	38	36	15
Jappa, or Jaffa	32	27	35	20
Jeruſalem	31	51	35	25
Alexandria	31	7	30	19
Cape Ruſato	32	48	21	25
Cape Meſurato	32	21	16	17
Tripoly	32	54	13	10
Suſa	35	53	10	34
Cape Bona	37	3	10	4
Tunis	36	50	10	17
Bona	37	2	8	14
Seven Capes	37	15	7	0
Gigeri	37	14	6	15
Cape Tidelles, or Dellys	37	15	4	18
Algier	36	50	3	16
Cape Tenes	36	45	1	50
Orain	36	2	0	26
Cape Tres Forcas	35	30	2	4W
Ceuta	35	54	4	45W
Tangier	35	42	5	22W

North Latitude.

Eaſt Longitude.

Iſlands within the Straits.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Formentura	38	33	1	55
Ivica	38	55	1	40
Majorca	39	35	3	5
Minorca	39	51	3	59
C. Tolare, South end of Sardinia	38	46	9	12
C. Corſo, North	41	10	9	50
Aſinaria	41	3	9	8
Bonifacio, South end of Corſica	41	24	9	46
C. Corſo, North	42	56	9	50
Capri, or Captia	43	3	10	27
Lilboa, or Elba	42	45	11	0
Planoſa	42	30	10	45
M. Chriſto	42	17	11	0
Palmarolla, or Palmerira	41	3	13	35
Ponſa	41	0	13	37
Iſcia, or Eſchia	40	54	14	30
Strombello	38	58	16	0
Velcanello	38	27	15	33
Fellicur	38	30	15	0
Allicur	38	28	14	42
Uſtica	38	36	13	52
Traperno Weſt-end of Sicily	37	57	13	13
Palermo in	38	6	13	50
C. Paſſaro Eaſt-end of	36	38	15	40
Meſſina in	38	7	16	20
Syracuſe in	37	3	15	45
C. Molin in	37	42	15	56
Pantalaria	36	48	12	20
Limoſa	35	56	13	11
Lampidoſa	35	34	12	46
I. Malta	35	53	14	34
Ouvre Poel, a Rock	35	45	16	36
Grande, or I. Longo	44	25	16	18

North Latitude.

Eaſt Longitude.

Iſlands within the Straits.

Names of Places.	Latitude D.	M.	Longit. D.	M.
Poma	43	10	16	8
St. Andrea	43	12	16	26
Liſſa	42	46	18	40
St. Auguſta	42	40	18	56
Corzola	43	3	17	32
Melada	42	52	18	6
Corfu	39	42	20	6
Chephalonia	38	15	21	0
Zant	37	46	21	14
Sapienſa	36	40	21	45

North Latitude

Eaſt Longitude

Iſlands in the Archipelago.

Taſſo	40	40	25	17
Lemnos	39	59	25	37
Metyline Cape Sigre	39	15	26	5
P. Olivia	38	57	27	0
Siatto, or Schate	39	22	23	58
Scio, or Xio	38	22	26	12
Patmos	37	20	26	45
Tino	37	35	25	36
Zio, or Sea	37	37	24	50
Forminia, Fermina, or Termine	37	24	24	58
Ferfante, or Siſanto	36	58	25	20
Millo, Mila, or Melo	36	40	25	0
W. end of Candia Cape St. John	35	15	24	0
E. C. Solomon	35	0	27	8
Rhodes North-end	36	27	28	38
South-end of C. Tranquill	36	1	28	28
S.W. end of Cyprus C. Baffa	34	57	32	23
Eaſt CStAndrea	35	31	35	0
South C. de Gaffe	34	30	33	10

North Lat itude.

Eaſt Longitude.

The Sea-Coaſt of Barbary and Guiney, from Tangier to Cape Bona Eſperance.

Names of Places.	Latitude D.	Latitude M.		Longit. D.	Longit. M.	
Cape Spartel	35	50	North Latitude.	5	49	Weſt Longitude.
Salle	33	51		6	25	
Cape Cantin	32	36		9	10	
Cape de Jeer	30	37		10	6	
Cape de Non	28	15		11	4	
Cape Bajadore	26	4		15	35	
Cape Blanco	20	32		17	35	
Cape de Verde	14	43		17	5	
River Gambia's Entrance	13	8		15	31	
Cape Roxo	11	50		15	4	
Cape de Monte, or Mount	6	23		12	0	
River Seſter, or Seſtos	5	24		8	36	
Cape de Palmas	4	13		6	45	
River St. Andrea	5	5		4	15	
Cape Three Points	4	28		1	50	
Cape Corſe	5	15		0	23	Eaſt Longitude.
River de Volta, or Accara	5	55		3	25	
Cape Formoſa	4	15		6	40	
New Calabar Entrance	4	42		8	33	
Old Calabar Entrance	4	10		9	45	
River de Camarones	3	25		10	10	
Iſland Fernand Poo	2	40		10	30	
Iſland de Prince, or Prince's	1	40		9	15	
River de Anger, or Angra	0	50		10	1	
Iſland St. Thomas	0	0		8	0	
Iſland St. Matthews	1	30	South Latitude.	6	1W	
Iſland Aſcenſion	7	20		13	15W	
Iſland Anabonia	2	10		7	27E	
Cape Lopas	0	55		9	55E	
Cape Negro	16	8		12	31E	
Iſland St. Helena Nova	16	0		6	4E	
Iſland St. Helena	15	56		5	41W	
River Congou	5	40		15	25E	
Cape St. Thomas	24	50		14	43E	

The Sea-Coaſt of Barbary and Guiney, from Tangier to Bona Eſperance.

Names of Places.	Latitude D.	M.	Longit. D.	M.
Cape Secos, Sego, or Seca	29	0	15	56E
Cape Bona Eſperance	33	55	18	29E
Cape Aguilhas, or Lagullas	34	54	21	12W
Iſland Triſtian de Acunha	37	5	13	50W

S. Lat.

The Sea-Coaſt of Brazil.

	South Latitude		West Longitude.	
Iſland St. Paul	1	20	25	30
Para River	2	50	42	47
Cape St. Roque	5	0	5	47
Rio Grande	5	20	35	57
Pernambuco	8	13	35	10
Cape St. Auguſtin	8	35	35	20
Iſland Ferdinand Lorenha	3	50	31	10
River St. Franciſco	10	50	37	50
Bay de Tudos Sanctos	12	46	41	0
Port Segura	16	31	40	35
Los Abrolhos	18	15	39	7
Spirito Sancto	19	59	42	10
Cape St. Thomas	22	10	42	15
Rio Janiero	22	54	42	4
Cape Frio	23	0	42	20
Iſland St. Catharines	27	50	49	0
River Grande's Entrance	31	55	52	0
Cape St. Maria	34	50	54	31
Buenos Aires	34	35	58	26
Cape de St. Andreas	38	40	63	5
Bay Sinſunda, or Sinfendo	42	30	68	0
Point de los Leones	44	0	70	40
River Camerones	45	15	73	0
Cape Blanco	46	50	72	7
Pepy's Iſle	47	20	66	40
Point of River St. John	48	40	74	34
Falkland's Iſle, the Eaſt-ſide	51	45	60	35
Cape Virgin Mary of Magele Straits	52	20	69	50
Strait Le Maire	54	34	73	1

The Sea-Coaſts of Brazil.

Names of Places.	Latitude D.	M.	Longit. D.	M.
C. Horn, the S. Part of Terra del Fuego	55	55	68	14
Iſland dos Picos	22	30	25	15
Iſland de Martinvas	19	30	26	55
Iſland St. Maria de Agoſta	19	40	29	10
Iſland Trinidada	20	30	30	0
Iſland Aſcenſion	7	20	13	15

S. Latitude. W. Longitude.

The Coaſts on the Main Continent in the Eaſt-Indies.

Names of Places.	Latitude D.	M.	Longit. D.	M.
Bay de Lagua	25	30	31	5
River St. Lucia	28	20	32	17
Cape St. Martin, or Maria	22	40	35	5
Cape Corientes	23	40	36	17
Moſambique	15	4	41	10
P. de Aquada, or del Gada	10	17	40	10
Cape de Falſo	9	0	39	20
Tongon	4	50	38	59
Mombaſo	3	50	38	30
Molinde, or Melinde	2	58	39	35
River Lamos	1	20	40	13
Magadoxa	2	50	45	20
Cape de Baſſas, or Boxos	4	6	47	38
Cape de Gardefoy	11	44	51	20
Aden	13	0	47	0
Mocha	14	10	44	50
Cape Martriaca	15	23	52	10
Defra	17	0	55	35
Cape Reſulgat	22	41	59	45
Defar	23	12	57	45
Baſſora, or Buſero	29	45	49	20
Gambaroon	27	20	56	40
Cape Glado	25	50	63	34

South Latitude. North Latitude. Eaſt Longitude.

The Sea-Coaſts on the Main Contiment in the Eaſt-Indies.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
River de Sinda, or Cinde	24	45	67	35
Dia Head	21	2	69	50
Surat	21	10	72	25
Deman	20	6	73	30
Bombay Iſland	19	18	73	6
St. John's	19	55	73	20
Chaule, or Choale	18	31	73	37
Dabul	18	23	74	30
Rajapour Iſle	17	2	74	10
Goa	15	31	73	50
Carwar	14	47	75	0
Manquelore	12	53	75	25
Tellecherry	11	42	75	25
Calecut	11	16	75	30
Cannanon	10	22	75	35
Cochin	9	54	75	55
Anjanga	8	29	76	25
Cape Comarin	7	50	77	25
Columbo in Zeylone	7	7	79	30
Point de Galie or Gallo, on the ſame	6	10	80	10
Dundre Head, on the ſame	6	2	80	45
Trinconomale	8	40	81	40
Great Baſſos Seoals	6	23	81	45
Jetrapatam	9	5	80	10
Negrapatam	11	1	79	55
Trincumbar	11	15	79	50
Porto Nova	11	45	79	44
Pondicherry	11	54	80	6
Fort St. David, or Tregapatam	12	5	80	55
Conymere	12	35	80	5
Fort St. George, or Madraſſapatam	13	11	80	12
Palliakate	13	40	80	50
Armegon	14	16	80	32
Petapoli	16	16	81	11
Due Point, or Mecha	16	8	81	32
Maſulipatam	16	28	81	40

North Latitude.

Eaſt Longitude.

The Sea-Coaſt on the Main Continent in the Eaſt-Indies.

Names of Places.	Latitude D.	M.		Longit. D.	M.	
Maſſipore	16	30		81	57	
Viſagapatam	17	43		83	57	
Brimlapatam	17	51		84	9	
Pondy	18	49		85	15	
Jacarnaut Pagod	19	51		86	42	
Atſepure	29	11		87	23	
C. Palmiras	20	42		87	52	
Balaſore Road	21	16		87	48	
Piply	21	25		87	57	
Hughly	23	9		89	5	
Dacca	23	57		90	55	
Caſimbazar	25	6		88	45	
River Bengal	22	17	North Latitude.	92	21	East Longitude.
River Aracan	20	10		93	40	
Pegu	17	5		96	56	
Malacca	2	12		102	10	
Formoſa N. Point	21	25		121	26	
Point Romania	1	16		103	15	
Point Cui	12	10		99	2	
Siam Entrance	14	18		100	55	
Cambodia Entrance	10	28		105	0	
Cape Anarilla or Avarilla	13	25		108	3	
Cochin, or Chinchen	14	5		107	56	
Tonquin	20	50		105	40	
Canton	23	14		113	6	
Amoye Iſland	24	35		116	50	
Hockſew	26	30		118	20	
River Swadia	27	51		118	50	
Liampo, Lingpo, or Ningpo	29	59		120	35	
Iſland Chuſan	32	6		118	35	
Nankin	32	55		120	1	
Pekin	39	44		116	28	

Iſlands in the Eaſt-Indies.

St. Paul	38	0	S. Lat.	77	25	E. Lon.
Romerans de Caſtelamas	28	45		67	17	
St. Joan de Liſbon	25	24		53	30	
Diego Roy s	19	50		61	30	

Iſlands in the Eaſt-Indies.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
St. Brandon	16	38	64	30
Mauritias	20	10	57	2
Malha	11	15	60	30
C. St. Mary S. — } End of St Laurence	25	33	46	10
C. D'Ambre N. —	12	10	51	5
St. John de Nova	16	30	42	40
St. Chriſtova	17	36	43	40
Mayetta	13	4	36	18
Johanna	12	10	45	3
Mohilla	12	5	44	23
Comero, or Angazecha	11	40	43	50
Morſia, or Monſia	8	7	40	15
Zanzebar	6	48	39	57
Penda	5	20	39	35
Comero	10	30	44	3
Coſmoledo	10	24	51	17
Juan de Nova	9	30	52	40
Aſtore Iſle	9	55	53	50
Agalega, or Gallega	9	47	54	31
Setta Hermanes	2	47	59	13
Quevelo, or Quebello	3	53	52	36
Baſſas de Banhas	5	5	48	46
Hermanos	3	32	54	45
Iſland Gratio	6	10	63	1
Padra Banhas	2	10	65	32
Baſſas de Chagos, or the Iſland Chagos	6	55	68	45
Three Germans	4	30	62	43
Croſs Iſland	4	10	58	5
Sacatora, or Zacatora	12	21	54	5
Iſland Abdeleur	12	4	53	4
Cubello	8	10	71	45
Malique	9	0	72	58
Garipe, or Gripe	10	40	72	37

South Latitude.

East Longitude.

N. Lat.

Iſlands in the Eaſt-Indies.

Names of Places.	Latitude		Longit.	
	D.	M. North Latitude.	D.	M. Eaſt Longitude.
Qualpena	10	0	73	30
Andomahon, or Antada	1	10	73	32
Ceylone South-end, C. Gallo	6	8	81	15
Waldiviæ South Part	0	25	76	22
North	7	14	73	4
Yas de Diego Reys	0	20	72	0
Mamila	14	25	117	6
Anian N.W. Point	19	30	107	0
N.E.	19	55	109	55
Japan S.E. Point	35	30	140	30
S.W.	35	0	128	30
Kocas	4	10	91	2
Andaman the Middle	12	35	93	19
Borneo W. Point	3	50	108	58
Nicobar	7	11	93	40
North Weſt-end of Sumatra	5	22	94	50
Bencola	3	55S	104	8
South Eaſt-end of Sumatra	5	22S	105	10
Jambe	1	19S	102	55
Bantam	6	11S	105	55
Batavia	6	9S	106	46
Manilla	14	36	120	56

The Southern Iſlands, or Cape de Verde Iſlands.

		North Latitude.		Weſt Longitude.
St. Antonio	17	4	25	12
St. Vincent	16	45	24	49
St. Lucia, or Round Iſland	16	40	24	45
St. Nicholas	16	30	24	3
Iſle de Sal	16	41	21	56
Bonaviſta	16	5	22	8
Mayo, or Iſland May	15	14	22	2
St. Jago	15	8	22	56
Fuego, or Fulgo	14	50	23	41
Brava's	14	40	24	2

The Canary Iſlands.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Sancto Porto	33	6	16	5
Madeira Weſt-end	32	37	17	28
Salvages	30	14	15	59
Palma	28	59	17	36
Ferro	27	54	17	45
Gomero	28	6	17	5
Pico Teneriff	28	23	16	28
Grand Canaria	27	52	15	38
Alleganſa	29	40	12	13
Lancerota	29	2	12	45
Forteventura South Weſt-end	28	5	13	36

North Latitnde.

Weſt Longitude.

The Weſtern Iſlands.

Corvo	39	50	31	30
Flores	39	30	31	29
Fyal	38	50	28	55
Pico	38	35	28	55
St. George	38	50	26	43
Tercera	38	55	26	14
Gratioſa in Eura	39	6	26	11
Whale Fiſh	39	37	25	11
Vajo, or Vegia	38	43	23	48
St. Michael	38	3	24	16
Formigas, or Hormigas	37	40	22	47
St. Maries	36	56	24	18

North Longitude.

Weſt Longitude.

The Sea-Coaſt of the North Part of America, Hudſon's Bay, and Newfoundland.

Cape Farewell	59	45	44	45
Cape Elizabeth	62	3	66	50
Iſland Reſolution	61	50	65	4
Queen Ann's Foreland	63	48	54	45
Salvages Iſland	62	40	70	17
Saliſbury Iſle	63	45	77	15
Mill's Iſle	64	26	80	18
Nottingham Iſle	63	30	76	53

North Latitude.

Weſt Longitude

The Sea-Coaſts of the North Part of America, Hudſon's Bay, and Newfoundland.

Names of Places.	Latitude D.	M.	Longit. D.	M.
Shark Point	64	30	82	55
Cape Southampton	61	55	86	18
Sir Thomas Roe's Welcome	64	15	92	4
Cape Churchill	59	0	95	20
Port Nelſon, or York Fort	57	10	93	58
New Severn	56	0	88	20
Cape Henrietta Maria	55	7	84	30
Viner's Iſle	53	5	84	3
Albany Fort	52	26	84	50
Mouſe River's Mouth	51	18	83	13
Point Comfort	51	24	81	11
Frenchman's River	51	20	80	14
Rupert's River	51	30	79	26
Charlton's Iſland	52	8	81	20
Danby's Iſland	52	15	80	56
Shepherd's Iſland	51	45	80	48
Solomon's Temple Iſland	53	35	81	0
Weſton's Iſland	52	58	82	48
Cubb's Iſland	54	10	82	40
Bear's Iſland	54	25	83	45
Baker's Dozen Iſland	57	56	81	25
Sleeper's Iſland	60	10	81	30
Mansfield's Iſle, the Middle	61	42	80	30
Cape Jones	54	55	78	58
Cape Walſingham	62	35	77	55
Cape Charles	62	10	75	35
Burton's Iſle	60	25	66	27
Bell Iſland	52	7	55	35
Gray's Iſland	50	35	53	25
Cape St. John	50	25	52	48
Pengwin Iſland	50	0	50	50
Cape Bonaviſta	49	15	52	12

North Latitude.

Weſt Longitude.

The Sea-Coaſts of Hudſon's Bay, Newfoundland, and New-England.

Names of Places.	Latitude		Longit.	
	D.	M.	D.	M.
Trinity Bay Entrance	48	52	52	20
Barcaleau Iſland	49	40	51	56
Conception Bay Entrance	48	20	52	8
Cape St. Francis	48	9	51	46
Cape Race	46	40	51	52
Bay of Bulls	47	50	51	29
St. John's Harbour	48	0	51	39
Cape St. Maria	47	10	53	23
Placentia Bay	47	45	53	58
Cape St. Laurenſa	47	30	54	23
Iſland St. Paul	47	10	58	18
Cape Roye	48	0	57	40
Virgin Rocks	46	6	51	7
French Factory	50	10	61	10
Bay of Breſt	52	10	56	57
Tadouſack	49	0	67	5
Quebeck	46	55	69	48
Anti Coſti Iſland, the Middle	49	40	69	45
Cape St. Charles, or Charles Straits	52	10	55	0
Cape Britain I. Scateri	46	8	58	30
Cape Sable	43	50	64	58
Point, or Port Royal	44	45	65	40
Penobſcut River	44	40	67	10
North Yarmouth	44	14	67	58
Paſcataway Entrance	43	26	70	10
Cape Ann Iſland	42	43	69	45
Cape Codd	42	12	68	55
Boſton	42	30	69	23
Plymouth	42	2	68	50
South of St. George's Bank	41	45	67	15
South End of Nantucket Shoals	49	50	68	23
Nantucket Iſland	41	15	68	48
Martha's Vineyard	41	14	69	9

North Latitude.

Weſt Longitude.

The Sea-Coaſts of the North Part of America, Hudſon's Bay, and Newfoundland.

Names of Places.	Latitude North Latitude.		Longit. Weſt Longitude.	
	D.	M.	D.	M.
Shark Point	64	30	82	55
Cape Southampton	61	53	86	18
Sir Thomas Roe's Welcome	64	15	92	4
Cape Churchill	59	0	95	20
Port Nelſon, or York Fort	57	10	93	58
New Severn	56	0	88	20
Cape Henrietta Maria	55	7	84	30
Viner's Iſle	53	5	84	3
Albany Fort	52	26	84	50
Mouſe River's Mouth	51	18	83	13
Point Comfort	51	24	81	11
Frenchman's River	51	20	80	14
Rupert's River	51	30	79	26
Charlton's Iſland	52	8	81	20
Danby's Iſland	52	15	80	56
Shepherd's Iſland	51	45	80	48
Solomon's Temple Iſland	53	35	81	0
Weſton's Iſland	52	58	82	48
Cubb's Iſland	54	10	82	40
Bear's Iſland	54	25	83	45
Baker's Dozen Iſland	57	56	81	25
Sleeper's Iſland	60	10	81	30
Mansfield's Iſle, the Middle	61	42	80	30
Cape Jones	54	55	78	58
Cape Walſingham	62	35	77	55
Cape Charles	62	10	75	35
Burton's Iſle	63	25	66	27
Bell Iſland	52	7	55	35
Gray's Iſland	50	35	53	25
Cape St. John	50	25	52	48
Pengwin Iſland	50	0	50	50
Cape Bonaviſta	49	15	52	12

The Sea-Coaſts of Hudſon's Bay, Newfoundland, and New-England.

Names of Places.	Latitude North Latitude.		Longit. Weſt Longitude.	
	D.	M.	D.	M.
Trinity Bay Entrance	48	52	52	20
Barcaleau Iſland	49	40	51	56
Conception Bay Entrance	48	20	52	8
Cape St. Francis	48	9	51	46
Cape Race	46	40	51	52
Bay of Bulls	47	50	51	29
St. John's Harbour	48	0	51	39
Cape St. Maria	47	10	53	23
Placentia Bay	47	45	53	58
Cape St. Laurenſa	47	30	54	23
Iſland St. Paul	47	10	58	18
Cape Roye	48	0	57	40
Virgin Rocks	46	6	51	7
French Factory	50	10	61	10
Bay of Breſt	52	10	56	57
Tadouſack	49	0	67	5
Quebeck	46	55	69	48
Anti Coſti Iſland, the Middle	49	40	69	45
Cape St. Charles, or Charles Straits	52	10	55	0
Cape Britain I. Scateri	46	8	58	30
Cape Sable	43	50	64	58
Point, or Port Royal	44	45	65	40
Penobſcut River	44	40	67	10
North Yarmouth	44	14	67	58
Paſcataway Entrance	43	26	70	10
Cape Ann Iſland	42	43	69	45
Cape Codd	42	12	68	55
Boſton	42	30	69	23
Plymouth	42	2	68	50
South of St. George's Bank	41	45	67	15
South End of Nantucket Shoals	49	50	68	23
Nantucket Iſland	41	15	68	48
Martha's Vineyard	41	14	69	9

The Sea-Coaſts on the Main Continent in the Weſt-Indies.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Elizabeth's Iſland	41	35	66	13
Block Iſland	41	15	69	58
Montock Point	41	18	70	20
Fiſher's Iſland	41	20	70	40
New York	40	58	73	53
Sandy Hook	40	28	73	59
Cape James, or Henlopen	38	48	75	28
Philadelphia	40	50	74	10
Cape May	39	0	75	15
Cape Charles	37	16	74	16
Cape Henry	37	0	75	24
Cape Hatteras	35	15	74	20
Cape Fear	33	58	76	50
Cape Roman, or Cattit	33	27	77	54
Aſhley River, or Charles Town	32	45	78	46
Port Royal	32	0	79	43
Bay of St. Auguſtine	30	10	80	43
Cape Florida	24	57	80	30
Laphillapina, or Apalachina	29	47	84	44
River Spiritus, Sanctus, or Miſchiſippi River's Mouth	28	54	96	50
Tompeck	22	20	100	15
Liva or Vera Cruz	19	12	97	48
Sierra, or Cape de Martin	19	10	95	45
Triſte, or Trieſt Iſland	18	10	91	20
Campecha	19	20	92	10
Cape Condeſedo	20	40	89	40
Cape Catocha	21	10	86	10
Salamancha	16	50	89	10
Cape Honduras	16	25	85	25
Cape Cameron	16	10	83	30

North Latitude.

W. Longitude

The Sea-Coaſts on the Main Continent in the Weſt-Indies.

Names of Places.	Latitude North Latitude		Longit. Weſt Longitude.	
	D.	M.	D.	M.
Entrance of Nicaragua	11	25	85	15
Porto Bello	9	33	79	45
Darien, or Scotch Settlement	8	30	78	45
Carthagena	10	28	75	21
Cape Conquiquaco, or Coquibaco	12	40	70	42
Iſland Curaſoa, or Quicaſo	12	10	68	15
Iſland Margaritta	11	20	63	20
Iſland Trinidada	10	15	60	17
Mouth of Oronoque River	8	15	59	25
Cape Three Points	10	30	62	10
Cape Naſſau	7	55	57	55
N. Cape, the Middle of Caopory Iſl.	2	5	49	56
Suranam	6	25	56	50
Cape Orange	4	25	50	55
Mouth Amazones River	0	0	49	56

Iſlands in the Weſt-Indies.

	North Latitude		Weſt Longitude.	
Tobago Weſt-end	11	10	59	16
Barbadoes, at Bridge Town	12	58	59	35
Granada	11	57	60	26
Granadillos	12	20	59	55
Boquia	12	50	59	53
St. Vincent	13	12	60	12
St. Lucia	13	55	60	4
Martinica	14	43	60	54
Dominica	15	23	60	30
Marigallanta	15	58	60	20
Guardalupa	16	10	61	15
Deſſedea	16	20	60	10
Antegua	17	5	61	45
Barbuda	17	56	61	40
Montſerat	16	45	62	15
Rodondo	16	55	61	15

Iſlands in the Weſt-Indies.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Nevis	17	5	62	32
St. Chriſtopher's	17	17	62	40
Euſtatia	17	25	62	20
Saba	17	35	62	40
St. Bartholomew	17	52	62	6
St. Martin's	18	6	62	10
Anguilla	18	17	62	13
Sambrero	18	35	62	30
Anegada	18	47	62	46
St. Cruz.	17	52	63	25
Virgins	18	30	63	25
St. Thomas	18	30	63	22
St. John de Port Rico	18	30	65	37
Iſlands and Rocks of Aves	12	1	64	30
Tortuga, or Tortugas	11	10	63	54
Margaritta	11	16	63	36
Blancho	11	50	63	40
Teſtigos	11	35	62	41
D'Orchila	11	45	64	30
Bonairy, or Bonaire	12	12	66	28
Arube	12	50	68	28
Eaſt-end of Hiſpaniola	18	18	69	15
Weſt-end of the ſame	18	26	74	36
Eaſt-end of Jamaica	18	0	75	40
Port Royal Jamaica	17	40	76	32
Weſt-end of the ſame	18	8	79	0
Eaſt-end of Cuba	20	15	73	55
Havannah	22	40	82	55
Weſt-end of Cuba	21	40	86	30
Bermudas	32	25	63	40
Bahama Iſland	26	50	79	26
Abaco South-end	26	0	73	46
Andrews, or Androſs, or North-end	25	10	78	50
Providence	25	0	77	20

North Latitude.

Weſt Longitude.

Iſlands in the Weſt-Indies.

Names of Places.	Latitude D.	Latitude M.	Longit. D.	Longit. M.
Harbour Iſland	25	37	76	47
Eleuthera South-end, or Hathern	24	40	75	56
Cat Iſland, the Middle	24	25	75	9
Watling's Iſland	24	3	74	35
Rum Key	23	45	74	50
Exuma	23	22	75	55
Crooked Iſland, North-end	22	56	74	12
Long Iſland, South-end	22	41	74	52
Atwood's Key	23	10	73	35
Mayaguana	22	35	72	46
French Keys	22	40	73	40
Merapervous	21	58	74	45
Hogſties	21	17	73	55
Hineago, Weſt-end	20	52	73	46
Weſt Caicos	21	38	71	58
Turk's Iſland	21	35	69	6
Abrollo Bank, the North-end	21	35	69	6
Plate Rack	20	10	68	15
Mucarcs	21	30	76	35
Verd	21	17	76	16
Cajad Zal	23	10	79	24
Pinos	21	20	84	20
Great Camains	18	54	81	29
Little Camains	19	30	80	24
St. Andero	12	33	81	27
Caimanuback	19	8	80	11
Pedro Shoals, North-ſide	17	10	77	56
St. Milan	17	10	81	28
Guayna	16	53	88	30
Cozumelli	19	30	89	5
Zuna Quita	17	1	89	48
Mexico	20	0	100	35

North Latitude.

Weſt Longitude

Theſe following were ſettled from Obſervation of the Moon's Diſtance from the Sun and Stars, made by Meſſrs. W. WALES F. R. S. and W. BAYLY, Aſtronomers, during Capt. COOK's Voyage towards the South Pole, and round the World, in His Majeſty's Ships the *Reſolution* and *Adventure*, in the Years 1772, 1773, 1774, and 1775.

Names of Places.	Latitude South Latitude.		Longit. fr. Lond. Eaſt Longitude.	
	D.	M.	D.	M.
CAPE of Good Hope	33	55	18	25
C. Duſky Bay, New Zealand	45	47	166	20
Charlotte's Sound, New Zealand	41	6	174	22
Point Venus, Otaheite	17	29	210	26
I. Ohitahoo, one of the Marquiſas	9	55	220	54
I. Tanna, one of the New Hebrides	19	32	169	47
I. Pudyoua, New Caledonia	20	18	164	44
Chriſtmas Sound, Terra del Fuego	55	22	290	0
C. Deſolation	55	13	288	37
York Minſter	55	31	290	18
C Horne	55	59	292	37
I. Uliatea	16	45	208	26
I. Huaheine	16	45	208	51
I. Eaoowe, or Middleburg	21	21	185	29
Tonga Tabu, or Amſterdam, friendly Iſles	21	4	185	13
Pyleſtaert Iſland	22	23	184	15
Tolago Bay	38	21	178	36
Portland	39	35	178	15
Mew Stone off Van Diemen's Land	43	48	146	30
Adventure Bay in ditto	43	23	147	33
Cook's Streights	40	48	175	7

Names of Places.	Latitude		Longit. fr. Lond.	
	D.	M.	D.	M.
C. Palliſer, new Zealand	41	35	175	3
Eaſter I. North-weſt Side	27	8	250	11
Reſolution Bay, Ohitahoo, one of Marquiſas	9	55	220	57
Bolabola	16	32	208	11
Savage Iſland	19	2	190	32
Turtle Iſland	19	49	182	6
Annamocka, one of the friendly Iſles	20	15	185	32
Mallicola, Sandwich Harbour	16	24	167	53
C. Quiros, Terra del Eſpiritu Sancto	14	56	167	23
Botany Iſland	22	26	167	20
Eaſt Cape of Staten Iſland	54	54	295	16
South Thule	59	34	332	18
Cape Montagu, N. 45 E.	58	33	333	17
Harvey's Iſlands	19	16	201	16
Howe's Iſlands	16	46	205	56
Palmerſton's Iſland	18	0	197	6
Southern King George's Iſland	14	34	212	44
Palliſer's Iſles	15	38	213	33
Taoukaa	14	29	214	53
Friendly Iſles, ſundry, which extend from	19	37	185	10
to	20	32	185	50
Aurora, North-end	14	52	168	16
Whitſuntide Iſle, N. End	15	28	168	24
Maſkelyne's Iſlands	16	30	168	0
Shepherd's Iſlands	16	56	168	44
Sandwich Iſland	17	29	168	25
Hinchinbrook Iſland	17	25	168	38
Montagu Iſland	17	26	168	33
Traitor's Head	18	43	169	23
St. Bartholomew Iſland	15	42	167	20
Cape Cumberland	14	39	166	50
Cape Colinet	20	30	164	59
Cape Coronation	22	5	167	11
Queen Charlotte's Foreland	22	15	167	15
Iſle of Pines	22	38	167	41
Norfolk Iſland	29	2	168	13
Cape Diſſeada	53	4	285	45

South Latitude.

Eaſt Longitude.

Names of Places.	Latitude D.	Latitude M.		Longit. fr. Lond. D.	Longit. fr. Lond. M.	
Cape Noir	54	32	South Latitude.	287	59	Eaſt Longitude.
St. Ildefonſo's Iſles	55	21		290	35	
Evout Iſles	55	34		293	4	
Cape St. Diego	54	33		294	49	
New Year's Harbour, Staten Land	54	48		295	52	
Cape St. Juan	54	47		296	16	
Willis's Iſles	54	0		321	33	
Cape North	54	5		321	48	
Cape Saunders	54	6		323	5	
Cape George	54	17		323	30	
Cape Charlotte	54	32		323	51	
Clerke's Iſland	55	5		325	21	
Friezland Peak	59	2		333	7	
Saunders Iſle	58	0		333	5	
Candlemas Iſle	57	10		332	50	
St. Helena	15	55		5	49	Weſt Longitude.
Iſland Aſcenſion	7	57		14	27	
Iſl. Ferdinando de Noronha	3	56		32	20	
Fayal, Villa de Horta	38	32	N. Latitude.	28	30	
Porto Sancto	32	58		16	22	
Madeira, Fonchal	32	33		17	8	
Palma, Middle	28	36		17	57	
Ferro Iſle, South-end	27	42		18	6	
Bonaviſta, North-end	16	14				
Terceira	39	14		27	22	
St. George	38	47		28	42	
Mavo, South-end	15	11		23	7	
St. Jago, Port Praya	14	54		23	26	
Kamptichatka Nos *Per Krinſhonicicoff*	56	10		198	36	
Drake Point, California	38	45		128	35	

FINIS.